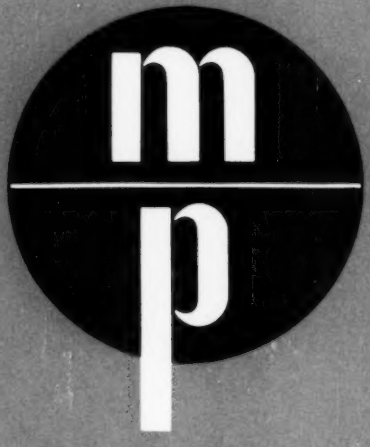
MODERN PLASTICS



OCTOBER 1951

It pays to use your custom molder's know-how

for reduced finishing, faster assembly, lower costs

No. 30 in a Series on Plastics Skill at Work...

PROJECT: Aircraft landing light motor housing and parts

CUSTOMER: Grimes Manufacturing Co. Urbana, Ohio

MOLDER: Plastic Research Products

MATERIAL: High-grade general-purpose Durez phenolic plastic

MECHANISM for lowering and raising landing lights from wings of aircraft is housed in four major moldings of Durez. Six smaller parts are used in the assembly. Molding-in of flanges, holes, ribs, and numerous metal inserts effects impressive savings. High-grade general-purpose Durez has the needed mechanical & electrical properties.

● "Now if only they'd made a plastic rugged enough for this assembly!"

Who hasn't heard this in design plan meetings? Odd thing is, often "they" DO make such plastics. Durez does especially, because we continue as always to specialize in the tough and versatile phenolics.

The main point, as shown in these aircraft landing light parts, is to counsel with a custom molder early in the proceedings. Your molder can take over wherever you want him to. Rewards may include reduced finishing, simplified assembly, lower material costs, quicker delivery, better performance.

When Grimes Manufacturing Co. changed the major and minor parts of this assembly from metal to molded Durez, a lot of machining was eliminated. The self-insulating property of the plastic made added insulation unnecessary. Molded-in metal inserts contributed further to lower assembly costs and faster output.

The availability of Durez may give you and your molder a valuable time advantage in using phenolics. Why not talk over your requirements with him? He'll know which Durez molding compound is best for your job. For further information and technical assistance, our field staff is always at your service.

Our monthly "Durez Plastics News" will keep you informed on industry's uses of Durez. Ask us to send a copy regularly. Durez Plastics & Chemicals, Inc., 1210 Walck Road, North Tonawanda, N. Y.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

PHENOLIC PLASTICS **THAT FIT THE JOB**

THIS IS the "Oriental Temple" aquarium—a Kolmar DECO*rator*. It's quite a fascinating idea! And, until curiosity compels you to peek behind the proscenium, you're apt to wonder how live gold fish and a marine garden manage their way into the setting.

The unit comprises three plastic parts . . . a frame, tank and stand . . . all molded of strong, lightweight, low-cost CATALIN STYRENE. The transparent, narrow, square-sided tank is cemented to the rear face of the ornate, colorful front panel. It is concealed within the overall framework. Thus, when viewed straight-on, you don't see the tank . . . your attention is held by the exquisitely framed action of a real life motion picture.

As a table piece, or suspended from the wall, with stand removed, this "mystery attraction" adds a welcome new note to the home scene.

We, of Catalin, are particularly happy to learn that Kolmar Plastics Co., Chicago, reports this entire line of popularly priced DECO*rators* to be a bright, sparkling sales hit!

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, NEW YORK

MODERN PLASTICS*

VOLUME 29 OCTOBER 1951 NUMBER 2

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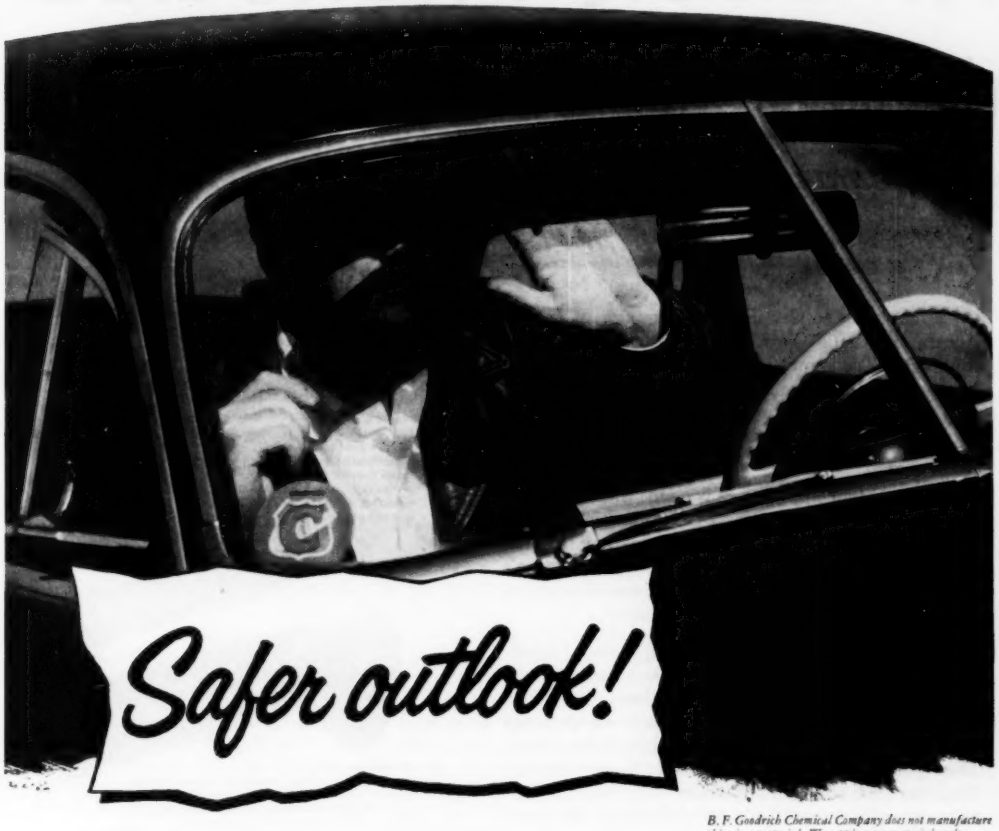
Modern Plastics, published monthly by Modern Plastics, Inc., at Emmett St., Bristol, Conn. Executive and Editorial Office: 575 Madison Ave., New York 22, N. Y. Published each month by Modern Plastics, Inc. Entered as second class matter at the Post Office at Bristol, Conn., December 14, 1950, under the act of March 3, 1879. Copyright 1951 by Modern Plastics, Inc. All rights reserved. Subscription $5.00 a year, $8.00 for two years in the U. S., its possessions, and South America. Canadian subscription $5.00 a year, $8.00 for two years. All other countries $5.00 a year, $8.00 for two years, payable in U.S. currency. Price of this issue 75 cents per copy. Printed in the U.S.A. by the Hildreth Press, Inc., Bristol, Conn.

* Reg. U.S. Pat. Office

Another new development using

B. F. Goodrich Chemical Company ***raw materials***



B. F. Goodrich Chemical Company does not manufacture this visor material. We supply raw materials only.

New "stick-on" visor made of GEON cuts sun glare

THIS new type sun visor is one of the most useful motoring "accessories" you've ever seen! It's called a "Visor Green", is a strip of transparent, green material made from Geon polyvinyl plastic.

You simply press it to the windshield surface. It clings securely—effectively reduces sun glare—helps you see easier to make driving safer. It can be peeled off without leaving a mark and can be used over and over again.

That's just the start of the advantages it gets from Geon. It is also washable and resists ordinary household chemicals. It remains flexible in summer and winter. And Geon's tear and abrasion resistance help the sun visor last for many years' service.

Geon materials resist heat and cold, gas, oil, many chemicals, weather and wear. They're ideal for developing and improving many civilian and defense products. Write for helpful technical advice. If you're interested in packaging materials, ask for the new booklet, "Packaging Problems Solved with Geon". Please address Dept. GA-10, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

RUBBER PHENOLICS

plus the know-how of CHICAGO MOLDED

— a logical combination for shock resistant parts

Is resistance to physical shock important in your plastics part? If so, better investigate the new rubber phenolics. True, some materials are stronger in other respects . . . but when it comes to shock resistance, the rubber phenolics are in a class by themselves. Actually, their shock resistance is 5 to 10 times as great as that of other impact-type materials!

Besides, their appearance is good, their electrical properties are excellent, and their machinability is outstanding . . . drilling and tapping small holes, for instance, is fast and easy. Sounds good, doesn't it? And they ARE good . . . for scores of exacting applications like the ones on this page.

This is the vital step toward insuring a sound application of rubber phenolics: choose a molder who knows WHEN and HOW to use them . . . a firm like Chicago Molded, for instance, whose experience with phenolics extends over more than thirty years. Here you will find a combination of know-how and facilities hard to equal anywhere . . . a combination that insures successful results right from the start.

Thermoplastics, too. We mold all other commercial plastics as well . . . in one of the largest, most modern custom molding plants in the world. So, whatever your job may be, you are certain of unbiased recommendations . . . a wholly unprejudiced viewpoint. Our one concern is to help you get the most out of your molded plastics job. That, perhaps, is one of the reasons why 60% of our business comes from firms we have served for 15 years or more.

The twelve integrally molded pegs on this 12½" x 7¾" panel hold the cutters and setters for the Landis Paneled Finisher, used in shoe repair shops. Handsomely molded to withstand hard service, by Chicago Molded Products Corp.

The handle of the Unity Plug-In Searchlight gets plenty of hard service under all kinds of conditions, but this handsome, two-piece handle of rubber phenolics can certainly take it. It's easy to drill and tap for assembly, too. Another Chicago Molded job.

Another part made to take hard knocks is this tool holder for the Landis 12L Stitcher. Economically molded in one piece, from rubber phenolic material, it eliminates the cost of an assembly operation formerly necessary.

If you are planning the use of rubber phenolics . . . or any other molded plastics . . . why not talk it over with a Chicago Molded engineer? There's no obligation.

Meanwhile, let us send you our booklet, "The Story of Plastic Molding." It's packed with interesting, useful information of value to every user of molded plastics. Write today . . . on your company letterhead, please.

CHICAGO MOLDED PRODUCTS CORPORATION

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CHICAGO MOLDED PRODUCTS CORPORATION

COMPRESSION, INJECTION AND TRANSFER MOLDING OF ALL PLASTIC MATERIALS

This is the Industry's Battle!

In any industry as broad as this, and embracing such a wide range of materials, processes, and applications, attacks by competing interests on one portion of the industry are all too apt to be shrugged off by the rest of the industry.

This is wrong. This must be changed!

Simply because of the size, scope, and nature of this industry, attacks upon it are always piece-meal by sections. These attacks come from the interests vested in the multitude of individual non-plastics materials that are competing with specific plastics materials. They are sporadic and their timing generally coincides with a new step forward in sales of the plastics.

While it is a fact that each section of the plastics industry, defending its own fronts against these sporadic attacks, has never lost a battle, it's also a fact that the spot battles would be more easily won if the industry stood with a united public relations front and if all our defensive forces could be brought to bear upon any local attack.

The latest in a long series of attacks upon plastics has been directed toward melamine tableware by the Vitrified China Association. So 17 molders and 3 raw materials makers are involved, out of all of the thousands of companies engaged in plastics. But the front chosen as the area for attack by the Vitrified China Association is the public health front; the time of attack on melamine tableware chosen by the Vitrified China Association is following the Army Quartermaster Corps' approval of melamine tableware for use in Army messes. Not the fact that it's melamine that's being attacked, but the selection of the battle area and the selection of the battle timing should bring home to every company in the plastics industry its own vital interest in this "local" battle.

Every molder of plastics packaging, every maker of plastics toys, every film and sheeting company, every coater, every extruder, and every maker of plastics materials of any kind, should recognize his stake in the winning of any battle on the public health front, and particularly when applications designed for approval of the Armed Services are involved.

As has been done in this blast, flying squad techniques are necessarily being used to do spot battle. And the ammunition of the melamine makers is so scientifically and functionally sound, their cause so just, that the battle will certainly be handily won.

But next week or next month another skirmish will open on another front. Remember that our attackers are losing business to us, and will use every possible propagenda weapon to create doubt about plastics in every mind. If they are desperate enough, public relations ethics will be forgotten, every vicious weapon will be used, pseudo-scientific reports will be published in the hope that, if we can't be beaten, at least our plastics may be discounted in public estimation.

Without the full power of the whole industry being brought into battle in these one-material or one-product skirmishes, we can win—and still lose much ground by reason of the doubt created by the very fact of the attack.

We are glad to learn that the S.P.I. public relations activity is to be strengthened and coordinated. Our first advice to the new Public Relations Committee is to demand resources and man-power sufficient that permanent full battle strength may be maintained to handle any and all attacks on segments of the industry.

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PLASTICS MOLDINGS

Every one of the plastics parts shown—from the 33-inch circular filter plate to the tiny part in the man's hand—was molded by The Richardson Company to solve a *special* problem.

For each of these parts, Richardson engineers developed a *new material*, a plastic with just the right combination of physical, electrical, and chemical properties to do the job. In several cases, the material had been considered "impossible" to produce before Richardson plastics engineers applied their broad experience and skill to the problem.

The Richardson Company stands ready to help *you* with this specialized plastics service. With its six plants, Richardson is one of the world's largest molders of plastics. Its extensive facilities are admirably geared for volume production of standard or special plastics parts—large or small.

Write for full information, today.

Only Richardson offers you this SPECIALIZED PLASTICS SERVICE

1 DEVELOPMENT OF SPECIAL PLASTICS MATERIALS

Richardson has the personnel and complete laboratory equipment for developing new plastics — including combinations of resin, rubber, etc.—for special applications.

2 DESIGN OF SPECIAL PARTS

Richardson handles your problem from beginning to end—analyses requirements; designs for appearance, performance, low cost; and develops the proper tools for quality and efficient production.

3 FACILITIES FOR SPECIAL MOLDING OR LAMINATING

Richardson can select just the right production method for your special plastics part, because they use *all* methods—including molding, laminating, fabricating, post-forming, and laminate-molding.

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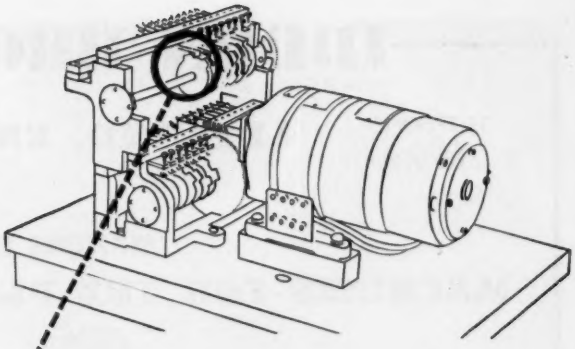
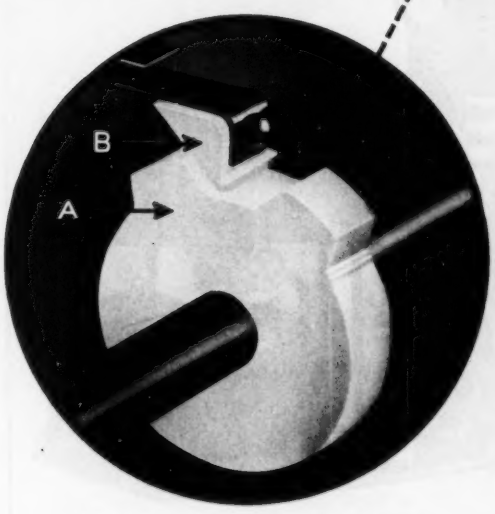


Cams of Du Pont nylon plastic wear longer

provide more accurate timing in telephone interrupters



NYLON CAM (a) is mounted on a shaft, driven by an electric motor. This turns slowly—from ½ to 15 r. p. m. Each cam bears specific contours which determine signals. When cam is pressed against nylon insert (b), the circuit closes, providing desired signal. Nylon parts molded by Victory Plastics Co., Hudson, Mass., for Holtzer-Cabot, Boston.

These revolving cams of Du Pont nylon plastic regulate the timing of busy signals and coded rings for your telephones. They do this by pressing against, then releasing, a nylon insert on a spring, which, in turn, closes and opens an electrical circuit. The nylon parts replace an intricate metal assembly, providing Holtzer-Cabot, the manufacturer, with interrupters that perform more accurately, last longer.

The nylon cam is supplied by the molder in the form of a blank, injection-molded to standard inside and outside diameters. The contours are then machined to meet signal requirements of individual exchanges. This vastly simplifies the manufacturing job, since the former part involved about 40 machining operations.

Smooth performance of the nylon parts gives more accurate control of timing pulses, measured in hundredths of seconds. What's more, they showed no sign of wear after accelerated tests equivalent to 3½ years of normal service. These tests indicate that new units with nylon cams and inserts will far outlast former assemblies.

Du Pont nylon plastic is finding many uses as an engineering material. It may pay you, as it did Holtzer-Cabot, to investigate its properties for future application.

Demand for nylon currently exceeds supply. However, we will gladly discuss the availability of experimental quantities for development work. For additional information on nylon and other Du Pont plastics, write:

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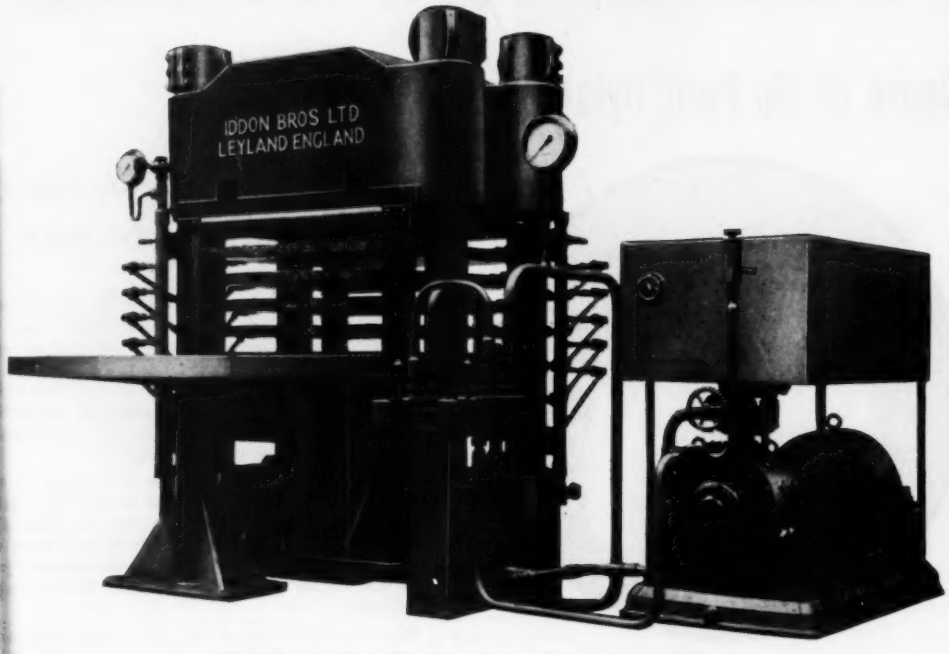

42" Square Five Daylight Press (24" diameter ram)
with Loading Table and Mono-Radial Pump

OVER 60 YEARS EXPERIENCE
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ENABLES US TO OFFER A RANGE OF MACHINES
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Goggles used by student during blind-flying instruction have filter lens of special blue acetate. Contrast is nicely with orange color pattern ... combination effectively blocks vision for student but not for instructor. Goggles manufactured by Pioneer Scientific Corporation, N.Y.C. and Rochester Optical Manufacturing Co., Inc., Rochester, N.Y.

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Celanese *acetate* Sheeting scores better . . . cuts easier . . . blanks perfectly. It can be stitched, solvent bonded and cemented to other materials. It can be heat-formed, drawn, blown...takes printing, stencilling and silk screen perfectly.

See your Celanese representative about Celanese *acetate* Sheeting, sold under trademark, LUMARITH*. It can be supplied in a wide range of lengths, widths and gauges, clear transparent or colored.

Celanese Corporation of America, Plastics Division, Dept. 101-J, 180 Madison Avenue, N. Y. 16. In Canada, Canadian Cellulose Products, Ltd., Montreal, Toronto.

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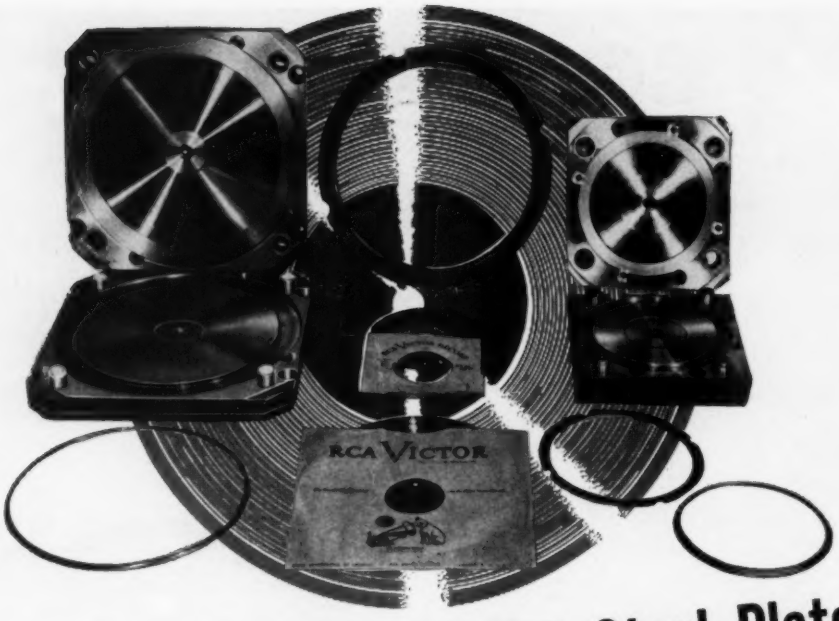

It's SPEED TREAT Steel Plate for *Record* Breaking *Record* Making

For a number of years RCA Victor has been making their phonograph record molds of Speed Treat (x1545) medium carbon open hearth steel plate—one of Holliday's Speed Steels. Both halves of the mold are made in two sections which are brazed together. A water and steam cooling chamber, subjected to 130 p.s.i. pressure, is provided within the two sections. The Speed Treat molds must withstand 3,500 p.s.i. pressure or 80 to 100 tons across the entire mold.

Speed Treat was selected because it brazes easily using silver solder and because of its greater machinability — molds machined complete in 22 to 23 hours. Speed Treat replaced 4130 forged steel. The molds are not heat treated. They operate at temperatures from 260° to 290° F. The flatness tolerance is .001 and the tolerance of parallel dimensions is .002.

Quality of RCA Victor Records is world renowned and record breaking quantities are not uncommon. Time-saving machining schedules and the necessity for a mold steel that "can take it" call for Speed Treat. The supply of Speed Treat is limited, but check with your nearest source. Keep yourself posted on this unusual plate steel.

The Speed Steels are: Speed Case (x1515), Speed Treat (x1545) and Speed Alloy hot rolled alloy steel plate.

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(INC.)

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Plants: Hammond and Indianapolis, Indiana

HAVE TO GET into production fast? Then that's another good reason for choosing an MPM extruder.

Your MPM extruder is delivered ready to run. There are no false starts. The cylinder and *die* controls, *screw speed indicator*, variable speed drive, fuses, switches, piping and everything else necessary for operation are in place.

All that's required is connection to water and electric service lines. No special foundations are needed because MPM extruders are comparatively vibration-free.

Add these facts to the many other outstanding MPM features — internal corrosion resistance, safety die head of improved design, and 9 to 15 individually jacketed cooling zones, for instance — and you'll know why MPM extrusion machines are so highly regarded by material manufacturers and extruders alike.

Consult MPM now for the ideal combination of versatility, reliability and high production in the world's most up-to-date extruder.

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BEHIND The Story of W-S "Completeline"... STANDS THE

THE SHORTEST DISTANCE BETWEEN PRODUCTION AND PROFIT

In a fast-paced industry like that of plastics molding, news becomes history almost over night. Only a few years ago, W-S was pioneering the "big" injection machines—eight, then 12, then a fabulous 16 ounces! Now, Watson-Stillman's high-speed production giants—the size of small locomotives — shoot almost 20 *pounds* per cycle.

Yes, plastics molding has come of age. What started only yesterday as a manufacturing business has become a major industry . . . its applications tested and proved . . . its markets huge and growing . . . its materials and products pronounced "critical" in the most vital fields of civilian and defense production.

W-S is proud of its right to claim an associate editorship in the "writing" of this typically American success story—the encyclopedia of plastics molding. We have worked closely with its chief editor—the molder himself—in developing the most complete line of production machinery anywhere available.

Always reflecting, and frequently anticipating the molders' needs, W-S has developed machinery ranging from one to 300 ounces capacity, and including complete installations for every material and method commercially employed in molding by compression, transfer, and injection techniques.

This kind of close association with the beginning, development, and assured *future* of the industry makes W-S more than ever your logical first-choice consultant on your present expansion or new-plant planning.

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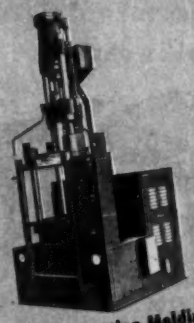
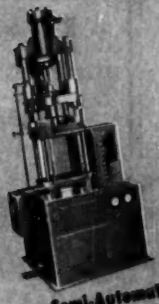
9-L-19

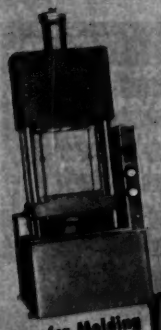
PLASTICS MOLDING...



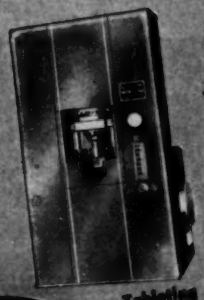
Vertical Injection Molding Machines 1, 2, 4 and 6 oz.



2 oz. Semi-Automatic Injection Molding Machine.



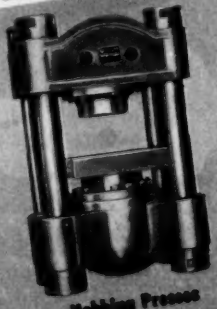
Transfer Molding Machines 30 to 1200 Tons.



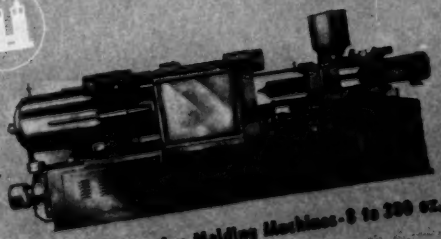
Preform Tableting Machines 10 and 100 Tons.

W-S 300 oz.
Injection Molding Machine
Die space 48" x 72" —Clamp 1500 Tons

Compression Molding Presses-50 to 1200 Tons.



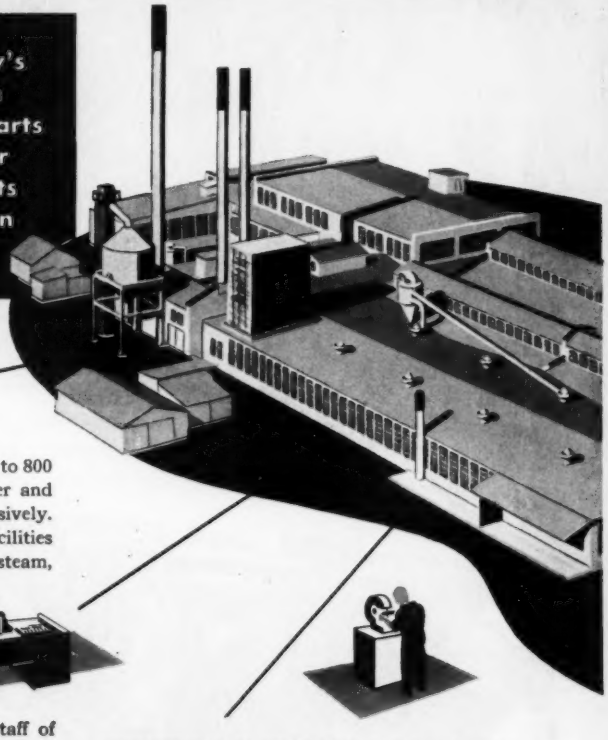
Hobbing Presses 200 to 3000 Tons.

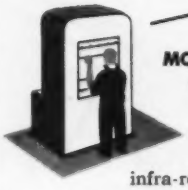


Horizontal Injection Molding Machines-8 to 300 oz.

Come to Kurz-Kasch

Come to one of the country's oldest and largest custom moulders of thermosetting parts with a background of over 10,000 different components moulded to the satisfaction of American Industry





MOULDING: 130 presses—10 to 800 tons. Compression, transfer and plunger moulding exclusively. Complete preheating facilities to service all presses—steam, infra-red and electronic.

ENGINEERING AND TOOLROOM: Complete staff of engineers and designers. Toolroom equipped for all mould making as well as special jigs and fixtures. Keller duplicating machine, 2,000-ton hobbing press, heat-treat equipment in addition to standard line of mills, lathes, etc.

FINISHING AND ASSEMBLY: Drilling, tapping, sanding, polishing, buffing, filing, profiling, tumbling, painting. Plenty of equipment for economically finishing any type of plastic part. Conveyor lines for speedy, efficient assembly work.

Kurz-Kasch

For over 35 years Planners and Moulders in Plastics

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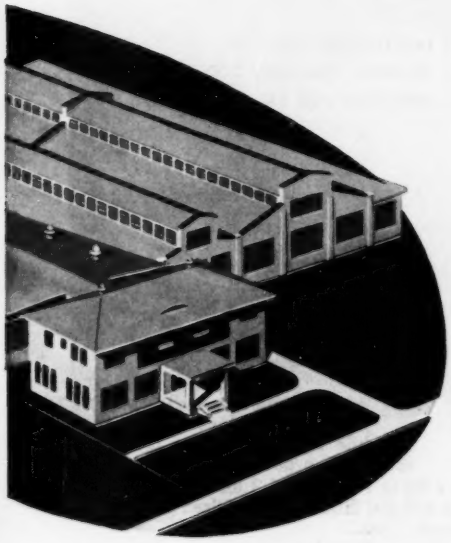
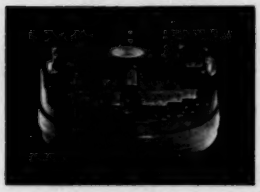
for Plastics Plus

All Thermosetting Materials—Teflon—Glass-Filled Polyester



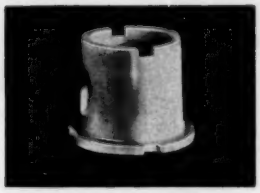
COMPANY POLICY: We have specialized in the moulding of thermosetting materials for the last 35 years, and we are today one of the foremost producers in the field. We pride ourselves on the truthful application of plastics—and this policy has netted us scores of customers who, as old friends, we still serve in the second generation. We are equipped to handle the entire job from design to finishing—to accept full moulding responsibility—to produce in large volume and ship on schedule. The K-K trademark on a plastic part stands for dependability—a promise made and met. Our consulting engineers are as close to you as your phone.

What K-K Research and Development Techniques Have Meant



STANDARD THERMOSETTING MATERIALS

Eight years ago a new material—an asbestos rag-filled Melmac—was developed into this "heretofore impossible" application. We've been meeting production schedules with the original moulds—on time—at a fair price—ever since.

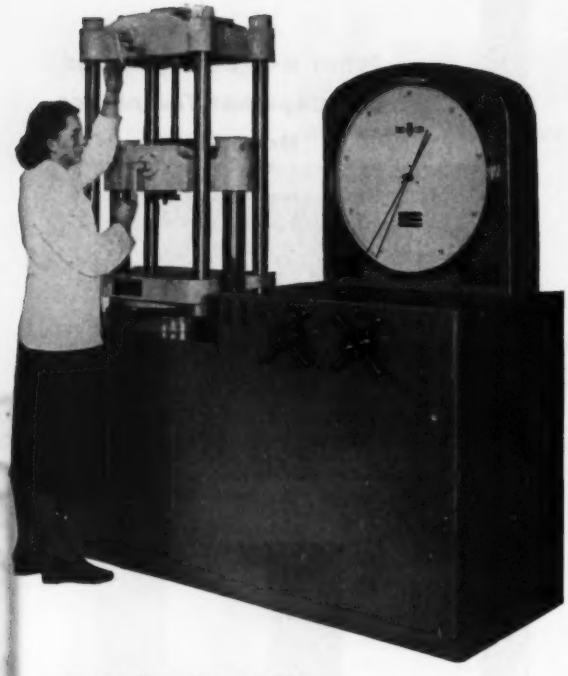


TEFLON VALVE LINER

Teflon is the most chemically inert material known—resists all acids, alkalies, etc.—is non-toxic—has zero water absorption—resists temperatures of 500° F. continuously—has excellent electrical qualities. Nothing known adheres to it—and moulded-in wax-like surface permits free turning without lubricants. We specialize in moulding complex shapes only—where machining of tube, rod or bar stock is undesirable. One of the first in the country to mould such shapes, we developed our own technique of pressing preforms, sintering and coining.

GLASS-FILLED POLYESTER ELECTRICAL PART

Now Kurz-Kasch engineers have solved the problem of moulding this material in complex forms and shapes—with holes and variable wall sections. CHARACTERISTICS: As a thermosetting resin, polyester offers excellent dimensional stability—good electrical characteristics—good resistance to chemicals and medium high temperatures. The glass fibres, with high tensile strength, are a good electrical insulator, are chemically inert and heat resistant. We will gladly discuss applications with you.



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No other testing machine has ever combined the worthwhile features that are incorporated in the new Olsen Super "L":

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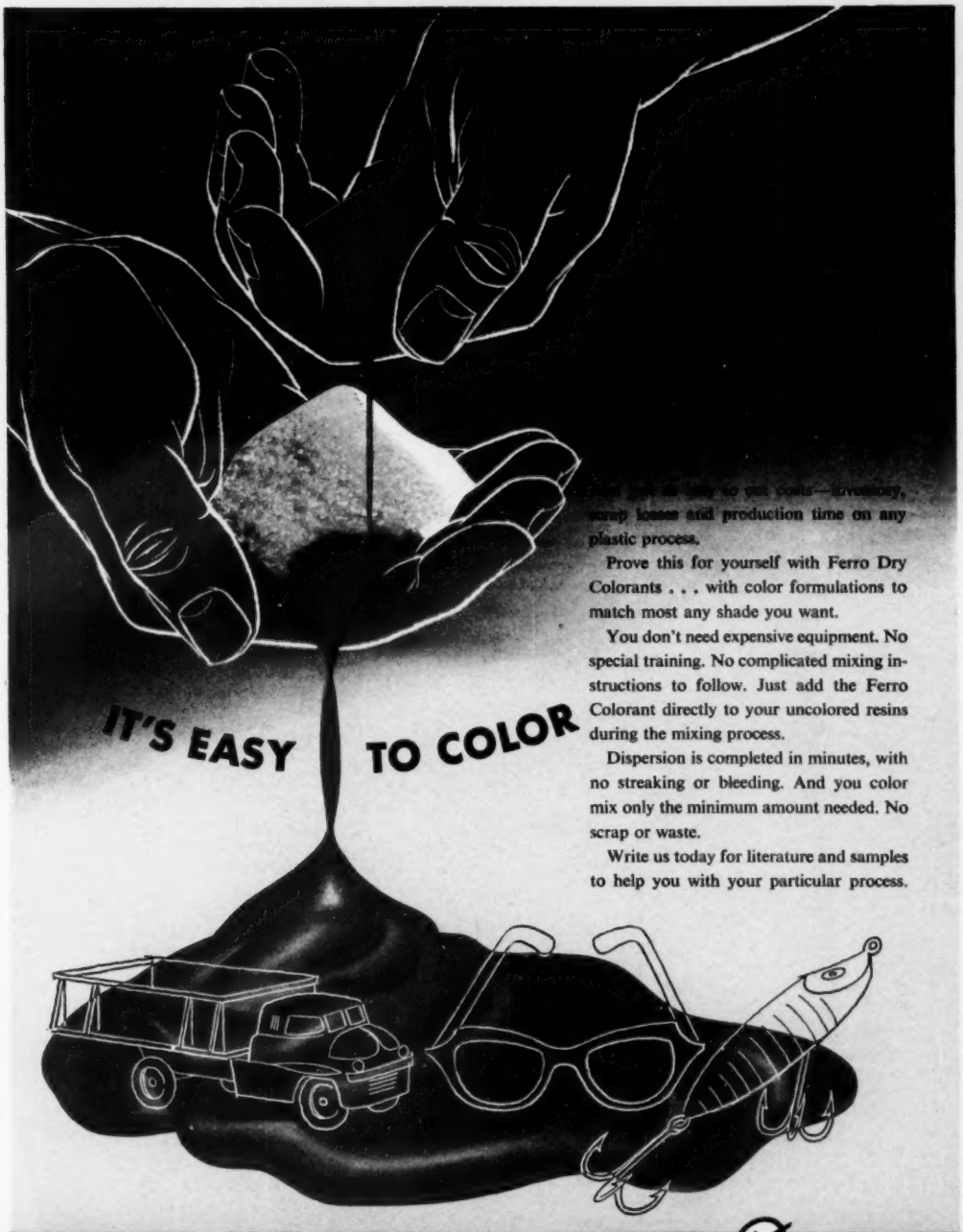

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Permanent—Can be used for permanent labeling. Removable when desired. Can be removed and relocated.
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Have you heard about Ideal's

$5,000,000

Ideal Plastics—Now the World's Largest Best Equipped Custom Injection Molder

When one of the country's large molding organizations steps out ahead of the crowd by expanding its facilities to the extent that it becomes *the largest injection molder there is* — it's important news! Well, that's what Ideal Plastics has done.

As a result of Ideal's recent unprecedented expansion, the immense 500,000 square foot plant is now equipped to mold 4,200,000 pounds of thermoplastics per month — an astounding volume!

And talk about machines! Ideal has fully *one hundred* modern high-speed injection presses to mold products to your specifications. The sizes of these machines range from versatile three-ounce units to 200 and 300-ounce giants that are capable of turning out an entire sink or one piece refrigerator interior *in a single shot.*

The molding presses are supplemented by two multi-million dollar toolrooms where highly skilled machinists make all of Ideal's molds, and by completely equipped departments for other essential operations including

electroforming	electronic sealing
cloth molding	assembling
fabricating	inspection
packaging	shipping

Better Molded Plastics **Ideal** *for Industry & Home*

EXPANSION!

Even the mightiest of machines are valueless without the trained personnel to run them. Ideal's staff, one of the finest in the injection molding industry, is composed of nearly three thousand technical experts and skilled laborers. This is a further guarantee that your products will be produced *on time, as specified,* and at *sensible prices.*

THESE PEOPLE WORK FOR YOU AT IDEAL

20 ENGINEERS

These are the elite of plastics technicians. Experienced designers with thousands of product successes behind them are at the focus of Ideal's activities.

83 MOLD MAKERS

The machines that translate engineering drawings into precision molds and dies need skilled operators. And these men fill the bill!

28 INSPECTORS

To guarantee delivery of perfect moldings exactly, each and every piece is carefully inspected before leaving Ideal's plant. Our standards are high.

14 DRAFTSMEN

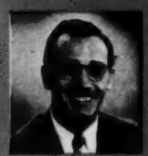
By interpreting the ideas of our engineers, they form a vital link with the workers who actually handle the manufacture of your products.

322 PRESSMEN

Molding is the most important thing we do, and our trained, alert press attendants help keep your costs down by holding rejects to a minimum.

83 PACKERS & SHIPPERS

Ideal has a large fleet of trucks, an in-plant railroad siding, and automatic case sealing equipment to expedite shipment of your merchandise.



8 RESEARCHERS

Ideal maintains complete chemical and physical laboratories for constant checking of raw materials and for maintenance of production standards.

466 ASSEMBLERS

Many of the items molded by Ideal need further processing such as cementing, painting, fabricating and the like. A full-time staff handles these details.

1610 OTHERS

Foremen, salesmen, bookkeepers, guards, maintenance personnel and the other individuals essential for efficient production of Ideal's many functions.

Start the Ball Rolling

Ideal's unequalled facilities can have a profoundly beneficial effect on your profit and production outlook. It is absolutely essential that you check with Ideal before placing any order—D.O. or otherwise—for custom injection molding.

By contacting Ideal now you will be throwing the switch which starts this giant organization working in your behalf. Write to A. C. Maxwell, Vice President in Charge of Sales, Ideal Plastics Corporation, 184-10 Jamaica Avenue, Hollis 7, New York. Phone AXtel 7-7000. Mid-West Representatives: Steel Age Products Co., 176 West Adams Street, Chicago 3, Illinois. Phone Central 6-5126.

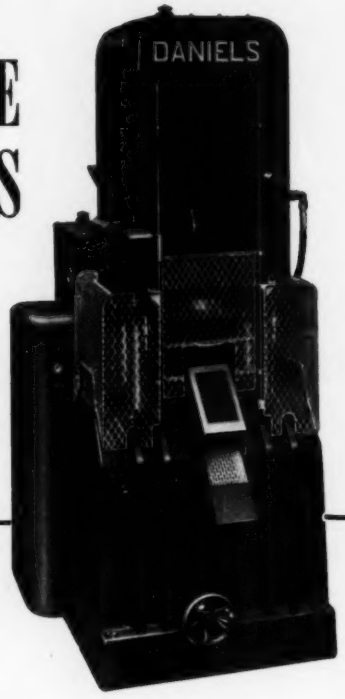
If . . .

YOU MAKE LARGE MOULDINGS

YOU NEED LARGE TABLETS

So . . .

THIS MACHINE IS A *MUST*



Hundreds of interested moulders saw the Daniels Hydraulic Preforming Machine making its debut at the British Plastics Exhibition, but for those who did not, we list below its main features:

Main frame of rugged cast iron construction, with easily removable covers so that pump, piping, reducing valves and timer are readily accessible.

Compression on tablet from top and bottom, owing to ingenious arrangement of floating main cylinder attached through columns to bottom crosshead, which carries the lower punch.

Double acting main ram for compactness, with inner prefilling ram to give rapid approach stroke.

Pump unit of the vane type, fitted at rear of machine. 15 H.P. motor.

Cycle control by modified Daniels Process Timer—operated from customer's air line (50-80 psi).

Guards completely enclose the machine, the sliding front one being interlocked with the control gear, giving perfect safety in operation.

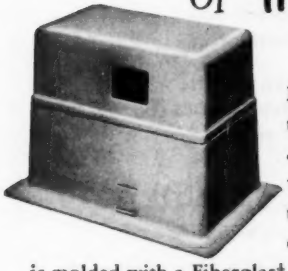
Tablet adjustment by the hand wheel at the front of the base. Dies are easily removed and interchanged, while a crosshead is provided to support a corepin if required. Any size and shape of tablet can be made which will go within a 6″ circle.

Completely automatic action, with provision for single cycle for difficult powders (i.e., rag filled).

Max. Load . . . 125 tons. Ejection . . . 20 tons. Max. size of tablet . . . 6″ dia.
Max. Depth of Fill . . . 6″ Speed . . . 3 or 4 strokes/min.

Write for leaflet D51/60. **T. H. & J. DANIELS, LTD.** ***Stroud, Glos. England***

The Tale of the Tougher Meter Housing



Rugged enough to take all the use—*or abuse*—you and the weather can give it, this attractive outdoor Meter Housing is molded with a Fiberglas† reinforcement.

Ten times lighter than the concrete unit it replaces, this housing protects costly utility meters and regulators from the ravages of weather, water, and soil corrosion . . . helps them give better service with less maintenance.

Zenith Plastics Co., Gardena, Cal., the molder, is just one of the many alert manufacturers who are making increasing use of Fiberglas-reinforced plastics to make a host of civilian and military products, such as washing machine parts, boats, fishing rods, aircraft components, and military instrument cases.

If you're looking for a unique new material that combines high strength, with light weight . . . that won't rot, rust, or absorb moisture . . . that is adaptable to volume production . . . then Fiberglas reinforcements are for you. Write today for details: Owens-Corning Fiberglas Corporation, Reinforced Plastics Division, Dept. 125, 16 East 56th Street, New York 22, N. Y.

*it's Plastic, reinforced with OWENS-CORNING FIBERGLAS Yarns

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† Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibrous glass.

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Metalmasters **is proud to have the trademark on its products, which include zinc and aluminum diecastings.**

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PLIOVIC	**40.5**	**3000**	**67**
Resin "X"	47.0	3100	65
Resin "Y"	46.0	3350	65
Resin "Z"	45.5	3000	68

*Plasticized to a modulus of 2000 psi at 100% elongation

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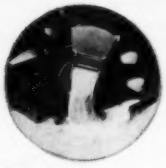
The 4-Way Mixing Action of the Sturtevant Dustless Blenders thoroughly mixes two or more substances into an inseparable whole . . . every part of which is the same analysis. Single receiving and discharging opening insures tight sealing during mixing process. "Open-door" accessibility permits thorough cleaning. The fast, accurate mixing operation increases output . . . cuts mixing costs. Available in many sizes with mixing capacities from ¼ ton to 75 tons per hour. Write for information and catalog.



Receiving — The ingredients to be mixed enter the mixing chamber of drums through a chute. Note scoops which carry up and dump the ingredients as drum rotates assuring a more uniform mix.

Discharging — Throwing a lever closes the inlet and mixer is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients.

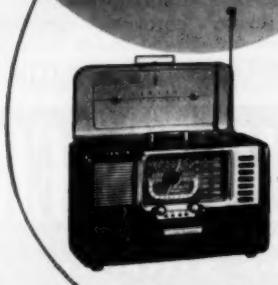
The Sturtevant Mill Company

110 Clayton Street, Boston 22, Massachusetts

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

at ERIE RESISTOR

every facility for every operation gives you Custom Injection Molded plastic parts ready for your assembly



The escutcheon plate for the handsome Zenith H-500 Trans-Oceanic Portable Radio was molded and decorated by Erie Resistor.

Erie Resistor is prepared to mold any plastic part, from the smallest to the largest. It is also prepared to perform any supplementary operations which are needed to complete the piece in every final detail.

It requires more than 10 operations to produce the finished beauty of this Zenith escutcheon plate; operations such as injection molding, foiling gold and black, drilling holes, spray-painting in black, green and gold, filling and wiping in white, destaticising, etc., and after careful, final inspection, packaging in a protective polyethylene bag and individually cartoned for shipping.

The fact that Erie Resistor has all of these facilities for finishing molded parts means economy for you in your final assembly. Write for our new bulletin: "Who We Are and What We Do in Plastics."

Plastics Division

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RECOMPOUNDING • RECOLORING

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REMOVAL OF FOREIGN MATTER
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UNLIMITED KILN DRYING FACILITIES

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As the world's leading Plastics Scrap Reclaimers we offer the almost unlimited facilities of our vast plant to industry in these days of shortages in all basic raw-materials.

We have available over 150,000 sq. ft. of floor space devoted exclusively to the processing of plastics — virgin and scrap — resinous materials or by-products.

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We also custom-compound *all* thermoplastics to your specifications.

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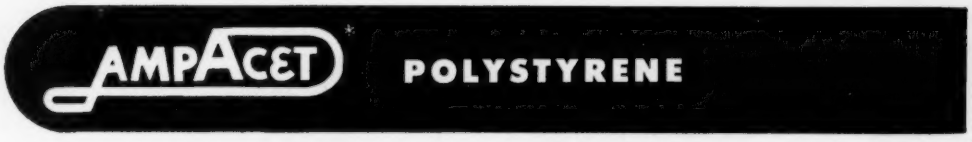
Unsurpassed for impact strength and durability, AMPACET EC has been accepted by the Armed Services for a multitude of uses. Whenever your product calls for the superior qualities of Ethyl Cellulose molding compound make it a point to consult us.



SPECIAL COLORS — SPECIAL EFFECTS

PHOSPHORESCENTS *for products that must glow in the dark, but retain their rich, colorful beauty in daylight.*

MOTHER OF PEARL, *the ideal plastic material for decorative articles — toilet wares and cosmetic containers, toys and nursery items, jewelry boxes, bathroom fixtures, clock and instrument housings.*

METALLICS AND TINSELS. *Unusual effects of sparkling brilliance.*

We custom color to your specifications—colors are matched accurately and kept constant time after time.

For injection and extrusion, formulated to meet your specific requirements.

As manufacturers of prime thermoplastic molding compounds we are geared to fulfill the most rigid specifications. Also, our large plant facilities enable us to cooperate efficiently with customers' special requirements for storage and drop shipping.

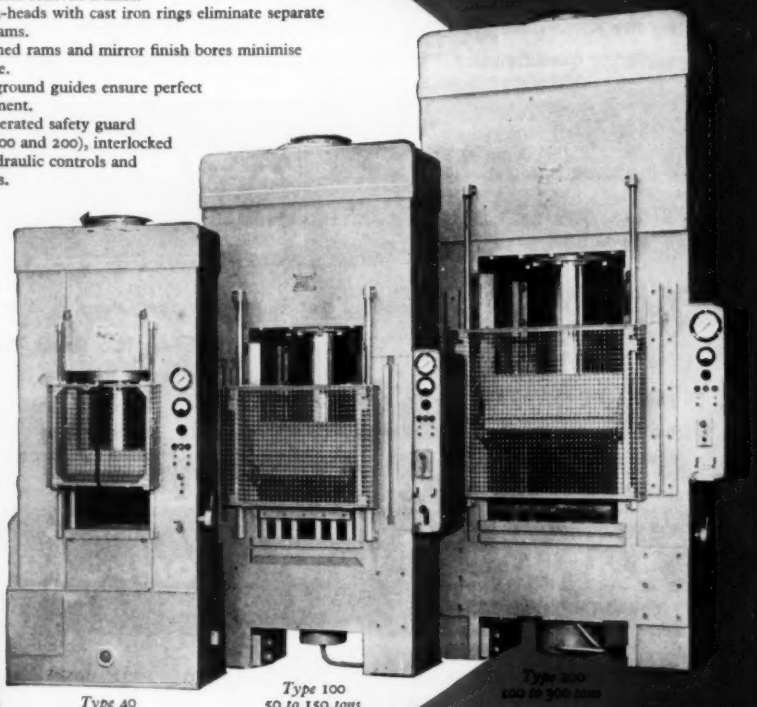
AMERICAN
MOLDING POWDER
and CHEMICAL CORP.
AN AFFILIATE OF A. BAMBERGER CORPORATION

703 BEDFORD AVENUE, BROOKLYN 6, N. Y.
Phone: MAin 5-7450 • Cable: CHEMPROD BROOKLYN

*Reg

BIPEL — 12 FEATURE auto-control presses

★ Choice of triple press tonnage from constant line pressure.
★ Self-contained or ring main drive.
★ Low power intake for high molding output.
★ Semi-automatic molding cycle reproduces ' breathing ' and ' dwelling '.
★ Optional transfer molding and ejector rams.
★ Three heat zone supply with accurate temperature control and indication.
★ Exceptional stroke and daylight.
★ Rigid steel stress-relieved frames.
★ Annulus ram-heads with cast iron rings eliminate separate draw back rams.
★ Hard chromed rams and mirror finish bores minimise maintenance.
★ Precision ground guides ensure perfect tool alignment.
★ Power operated safety guard (Types 100 and 200), interlocked with hydraulic controls and scotches.



Type 40
20 to 60 tons

Type 100
50 to 150 tons

Type 200
100 to 300 tons

modern in conception— proved in practice

B·I·P GROUP

B.I.P. ENGINEERING LIMITED · ALDRIDGE ROAD · STREETLY · STAFFS · ENGLAND

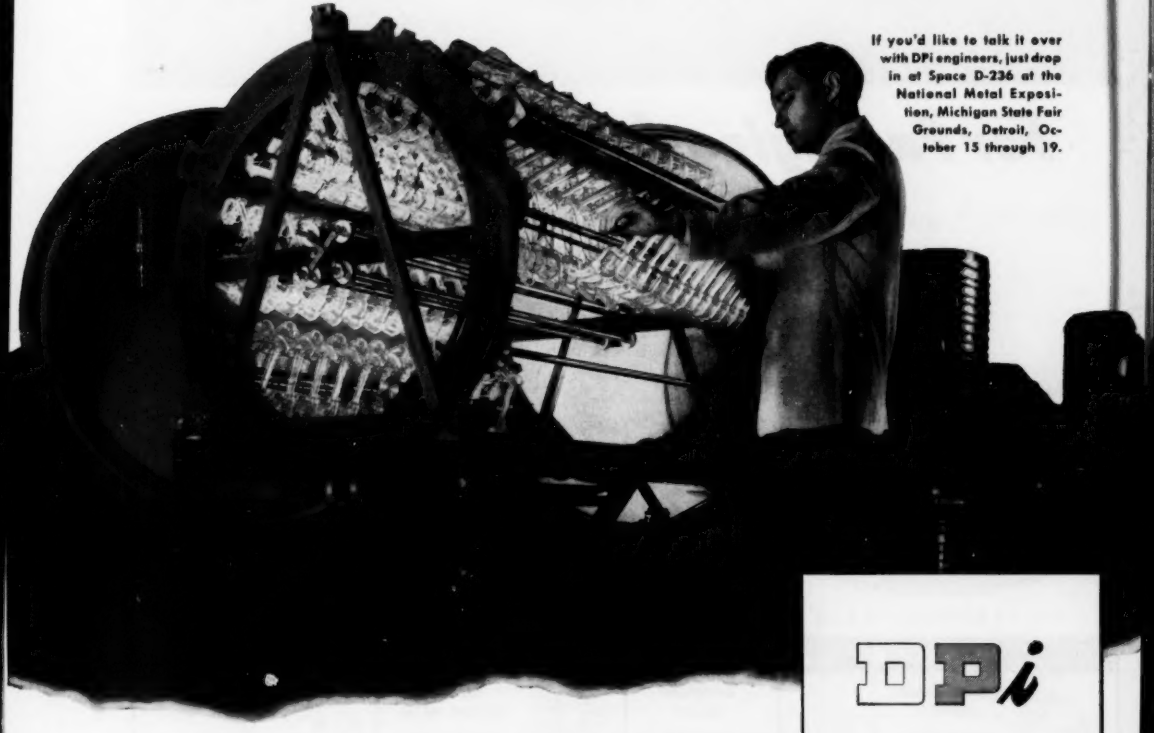
"Hardware" for half-pint he-men by **High Vacuum**

THESE toy pistols are molded from clear polystyrene. Yet, after a session in a DPi high vacuum coating chamber, a .000005"-thick film of aluminum makes them look more dramatically metallic to six-year-old eyes than the real thing.

Real hardware is also being manufactured from various plastics in this way—items like doorknobs, where appearance counts heavily. High vacuum coating makes possible finishes never before seen on the hardware market. It also keeps production lines moving for manufacturers of decorative hardware, by removing them from priority competition for scarce metals.

You'll also be hearing a lot soon about vacuum-depositing the most brilliant of metallic films on a specially lacquered base of inexpensive, abundant secondary metal—then protecting this finish with a highly durable transparent overcoat.

There is nothing mysterious about these new methods, even though they result from research originally undertaken by DPi years ago for scientific applications. DPi has lived with them from their faint beginnings, and the experience of our engineers, both in vacuum technique and lacquering operations, is at your disposal to lead you into profitable production. Just write to ***Distillation Products Industries,*** Vacuum Equipment Department, 779 Ridge Road West, Rochester 3, New York (Division of Eastman Kodak Company).

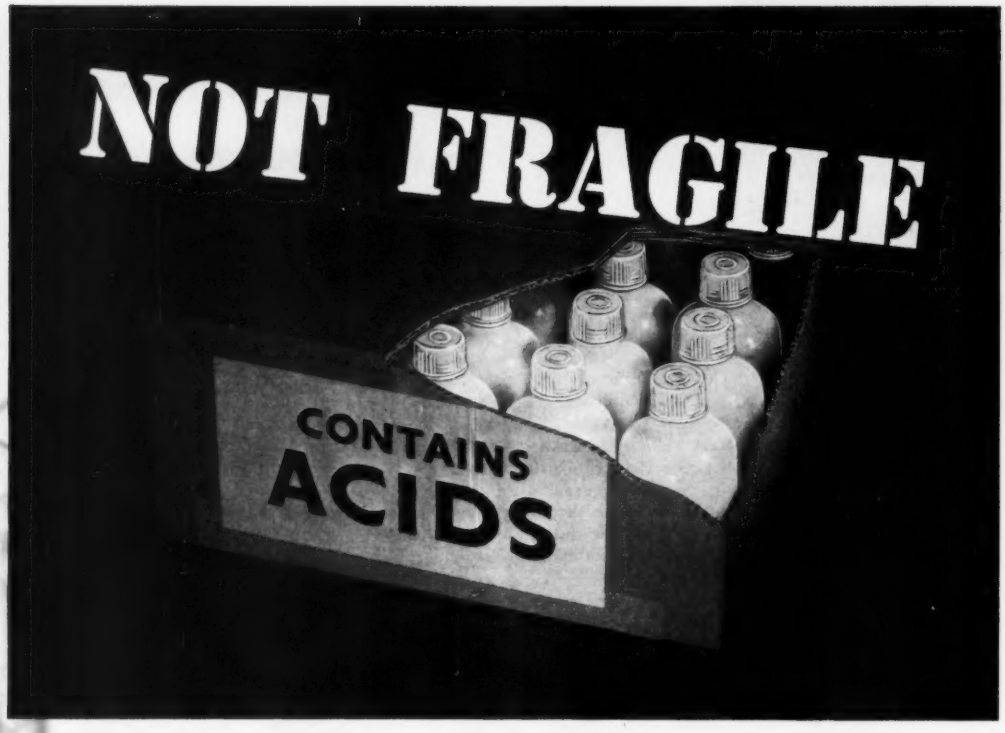


If you'd like to talk it over with DPi engineers, just drop in at Space D-236 at the National Metal Exposition, Michigan State Fair Grounds, Detroit, October 15 through 19.

DPi

high vacuum research and engineering

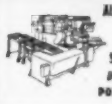
Also . . . vitamins A and E . . . distilled monoglycerides . . . more than 3400 Eastman Organic Chemicals for science and industry



For Packaging Acids so that they can be shipped, stored and handled without fear of breakage, on the ground or in the air. Need to get a highly corrosive or expensive chemical somewhere in a hurry? The Plaxpak bottle is the answer. Take it high in the sky. Unequal pressures will cause it to flex, but not break or pop its closure. Drop it on the ground. It will bounce, but not break. Shipping weights are drastically reduced. When compared empty, the Plaxpak bottle is one-fifth the weight of glass; when filled, one-half the weight.

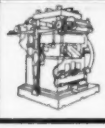
Only the best is

OTHER EMHART PRODUCTS INCLUDE:



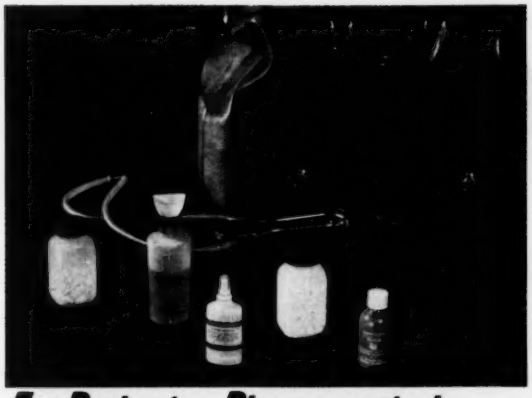
AUTOMATIC PACKAGING EQUIPMENT
STANDARD-KNAPP
Division of Emhart Mfg. Co.
PORTLAND, CONNECTICUT

GLASS MAKING MACHINES
HARTFORD-EMPIRE CO.
Division of Emhart Mfg. Co.
HARTFORD 2, CONNECTICUT

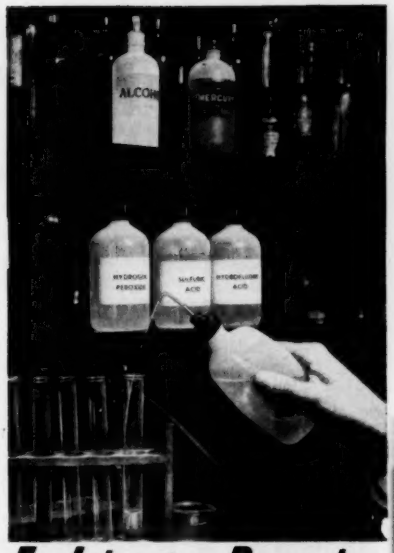


HIGH SPEED AUTOMATIC PRESSES
HENRY & WRIGHT
Division of Emhart Mfg. Co.
HARTFORD 5, CONNECTICUT

PREMIUM QUALITY STAMPING PRESSES
THE V & O PRESS CO.
Division of Emhart Mfg. Co.
HUDSON, NEW YORK



For Packaging Pharmaceuticals in liquid or powder form, the Plaxpak bottle offers the triple advantages of unbreakability, lightweight and, where desired, controlled dispensing as a spray, stream or droplet. Shown above are some stock bottles for medicinal use.

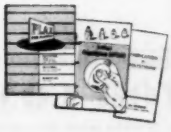


For Laboratory Research the Plaxpak bottle provides the convenience of an unbreakable, chemically inert container, and the added advantage of controlled dispensing. The stream dispensing fitment shown above was developed by S. H. Ansell & Sons, Boston, Mass.

For Boosting Turpentine Production the Plaxpak bottle has proven an invaluable aid. It is used as a container for sulfuric acid, which is squirted into "wounds" in the tree to increase sap flow. Safe, easy to handle and inert to the acid, the Plaxpak bottle speeds up operations, vastly increases manhour output and helps to lengthen tree productivity.

good enough

HELPFUL PLAX LITERATURE
Catalogs on Plaxpak bottles and other Plax products are available on request. Also available is a booklet "Fabrication of Polystyrene."



PLAX FOR PLASTICS
NOT SUBSTITUTES IMPROVEMENTS

PLAX CORPORATION
Subsidiary of Emhart Mfg. Co.
P. O. BOX 1019, HARTFORD 1, CONN.
In Canada, Plax Canada, Ltd., Toronto
Sales Offices: New York City, Syracuse, Philadelphia, Cincinnati and Chicago.

Plax blow-molded products are made under the following U. S. Pats.: 2128239, 2175053, 2175054, 2230190, 2260750, 2283751, 2349176, 2349177, 2349178, 2230188. *Reg. U. S. Pat. Off.

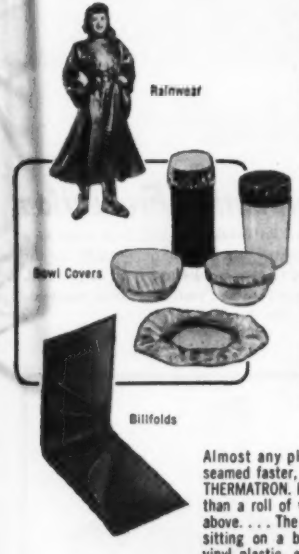
Do Your Seams Have . . . *SA?

THE "WELD" DRESSED GIRL'S SEAL OF APPROVAL

for better sealing of vinyl plastics

Thermatron

ELECTRONIC SEALING AND HEATING EQUIPMENT



PRODUCTS FABRICATED FROM VINYL *look* smarter, have more "sell" when they are seamed the modern electronic way. THERMATRON *welds*, doesn't *stitch* plastics; produces controlled shape and fit, and seams that outlast the material itself. . . . Eliminates weakening perforations. THERMATRON seams are airtight and watertight.

The time-tested THERMATRON electronic welding process is a production man's delight because it does more in seconds with less labor than the power sewing machine does in endless minutes.

In these days of rising costs and manpower shortages it should be refreshing to know there is a technological advance in *your* industry that can speed up *your* production at less cost – and give you a sturdier product.

Write us now. THERMATRON engineers may hold the key to more profitable production in *your* plant. . . . No obligation, of course. We'd like to send you a copy of our bulletin No. 62.

Almost any plastic product can be seamed faster, cheaper, better on the THERMATRON. In fact the list is longer than a roll of vinyl. A few are shown above. . . . The "Weld" Dressed Girl is sitting on a beach chair cushion of vinyl plastic, and wearing shoes that are THERMATRON welded.

Standard THERMATRON models from ¼ KW to 6 KW weld vinyl from .002" to .080", serving most requirements—or we can build to special application. Equipment also available for sealing cellulose acetate, and for electronic gluing of furniture and other wood products.

Thermatron DIVISION

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

Sales Dept.: 251 W. 19th St., New York 11, N. Y. • Factory: 84 N. 9th St., Brooklyn 11, N. Y.

Saves time and money for you!

● Waterproof Cloth Belts by CARBORUNDUM offer you many time and money-saving advantages in wet sanding. They run smooth, with "splice throb" eliminated. A constant cutting rate is maintained throughout belt life. "Wet stretch" is retarded, resulting in less down-time for tensioning adjustments. Pre-buff finishes generated in minimum contact time.

● CARBORUNDUM also manufactures a complete line of bonded products for dry and wet cut-off work. *See your* CARBORUNDUM *salesman or distributor, or write Dept. MP 82-124.*

Coated Abrasives by

CARBORUNDUM

TRADE MARK

Making ALL abrasive products . . . to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, N. Y.

82-124

Skillful Moldings by Industrial Plastics...

Product: ICE CREAM FREEZER

Now everyone can enjoy real old fashioned ice cream without any extra labor. But, the problems of providing an ice retaining bucket for this product were not so simple. No. 1, it had to withstand below freezing temperatures without becoming brittle or subject to breaking. No. 2, it had to resist the salt action that brought about the freezing temperatures. No. 3, it had to have relatively good impact strength for household usage. The result: a deep cavity molding of sparkling white acetate produced by injection molding.

Industrial Plastics is ready to solve your problems of plastic molding with: Complete engineering and design service—Injection, compression or plunger transfer molding—assembly—painting—hot stamping and packaging. Just call, write or mail your prints for an estimate.

How Industrial Met Requirements

for Chicago Electric Mfg. Co., Chicago, Ill.

In the course of years, many leading manufacturing organizations have learned to depend upon the design and molding services of Industrial Plastics for prompt, economical fulfillment of their requirements involving the use of plastics. Whenever your company needs this sort of service, ask us to confirm what we can do for you. No obligation.

Serving the Greatest Names in Industry

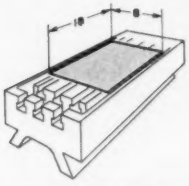
Industrial Plastics Co.

A Division of INDUSTRIAL ABRASIVES INC.

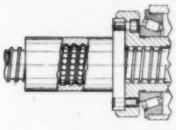
1829 S. 55th Avenue Chicago 50, Illinois

Cleans up the ears too!

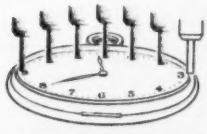
Universal cutter head . . . can be swiveled to the angle most advantageous for milling fine details.



In one setting, without repositioning the cutter head, work or master, chips can be cut throughout an area of 8" x 18".



Antifriction feed screws for cross and longitudinal movements reduce the effort of turning handwheels to almost zero.



Extra sensitive automatic depth tracing unit of CINCINNATI 8" x 18" Tool and Die Milling Machine will trace over any master without marring it.

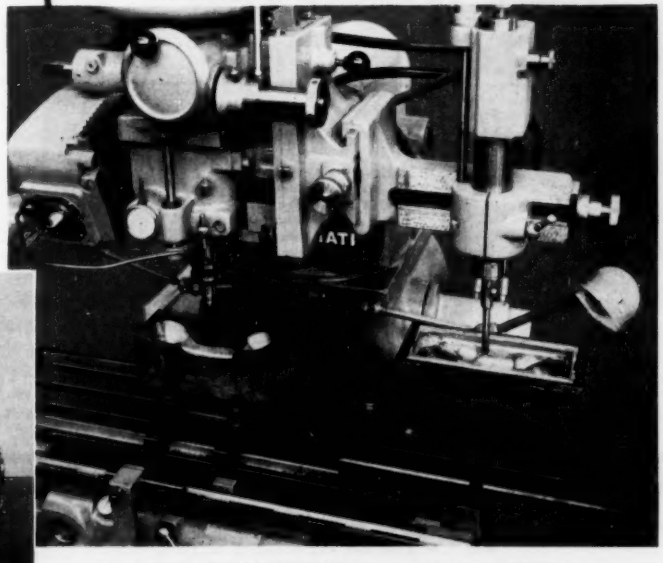
CINCINNATI

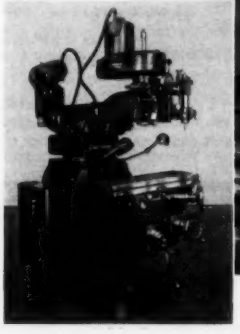
Attention to small details like ears may irk junior, but it's an important consideration to doll manufacturers. And for a good reason. The hob to produce a mold for the face and ears is milled in one setting of the work. Performing the operation on a CINCINNATI 8" x 18" Tool and Die Miller offers the advantage of a wide swivel adjustment of the spindle head, giving the operator a chance to obtain fine detail in the ears . . . the face is easy. (Note drawing at upper left.) Hand finishing time on the hob is greatly reduced; appearance of the finished product improved. ¶You'll find this feature extra useful when necessary to reproduce fine detail on an angular or curved surface, and for conventional milling operations required to complete dies and molds. Other cost reducing features are illustrated at the left. More information may be obtained by writing for catalog No. M-1731.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES
BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID





Milling the die for a telephone part on a CINCINNATI 8" x 18" Tool and Die Milling Machine.

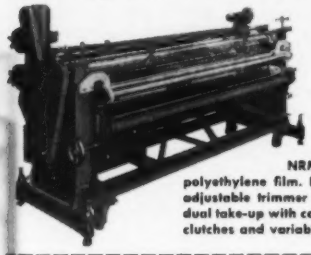
NRM THERMOPLASTICS FILM EXTRUSION EQUIPMENT

for producing film, tubing, and sheeting for packaging

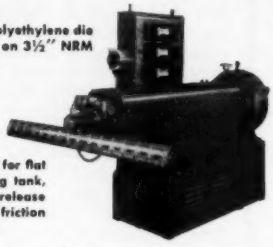
All NRM extruders can be equipped with dies and haul-offs for the extrusion of P.V.C. and polyethylene film and thin-wall expanded tubing.

NRM Haul-off and Wind-up units cool, trim, and wind up polyethylene film at a rate of 250 to 300 pounds per hour . . . have a thickness range of .001" to .010" and can maintain tolerances of plus or minus 5/10%. They are available in 48" and 72" sizes.

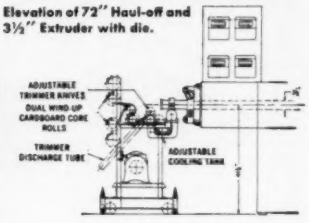
Haul-off and Wind-up sections are powered by a variable speed drive to suit the size of extruder used in connection with the machine. Dies for polyethylene film used with this take-up fit all sizes of extruders and are available complete with heaters and controls.



NRM 72" Haul-off for flat polyethylene film. Includes cooling tank, adjustable trimmer knives, quick release dual take-up with constant tension friction clutches and variable speed drive.

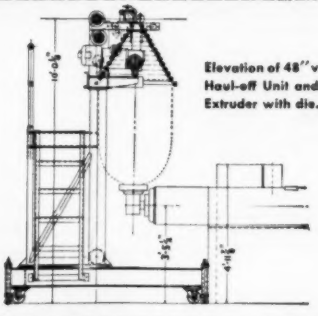


T-type polyethylene die mounted on 3½" NRM extruder.

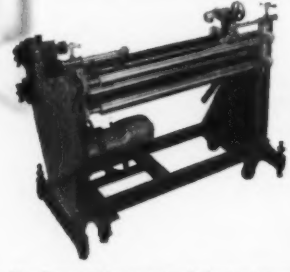


Elevation of 72" Haul-off and 3½" Extruder with die.

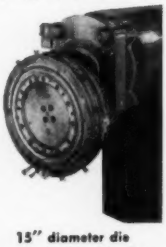
NRM 48" vertical Haul-off for thin-wall expanded P.V.C. and polyethylene tubing. Has variable speed drive, including flattening roll arrangement, adjustable trimmer knives and dual take-up.



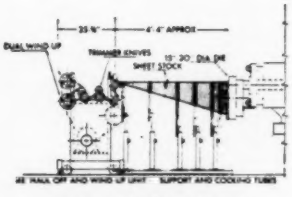
Elevation of 48" vertical Haul-off Unit and 3½" Extruder with die.



NRM 48" Haul-off for P.V.C. sheeting. Includes two water-cooled receiver rolls, adjustable trimmer knives, quick release dual take-up with constant-tension friction clutches, and variable speed drive.



15" diameter die attached to extruder.



Elevation of 48" Haul-off for heavy-gauge P.V.C. sheeting.

The first machine to extrude heavy-gauge polyvinylchloride sheeting (.005" to .015", and a possible .020") produces sheeting with physical quality equal or better than that of sheeting produced by calenders.

Cost of a complete unit is much less than cost of a calender installation. The economy of the extruder can best be realized on applications where high speed and close tolerances are not imperative.

NATIONAL RUBBER MACHINERY CO. General Offices & Engineering Laboratories Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
AGENTS East: National Rubber Machinery Co., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
EXPORT Plastics Machinery: OMNI EXPORT CORPORATION
460 4th Ave., New York 16, N. Y.

Creative Engineering

Ethyl CAPS THEM ALL!

Ethyl cellulose caps this cartridge, the ammunition for one of industry's newest power tools—the Remington Stud Driver. A tiny heelcap molded with Hercocel* E positions a hardened steel stud driven by an explosive force capable of penetrating structural steel ¾-in. thick.

For this demanding job, no other plastic affords, at comparable cost, all the advantages of Hercocel E. It won't crack or shatter when the Driver is fired. There's no pickup of the plastic in the gun barrel. Hercocel E will retain its shape under widely varying climatic conditions and during long periods of storage, yet is resilient enough to assure a snug fit for twenty different types of studs produced to commercial tolerances.

Hercocel E takes tough jobs like this in its stride. Perhaps this versatile, quality plastic can help you. Hercules will be glad to provide design and technical assistance in adapting it to your individual needs. Your inquiries are invited.

HERCULES POWDER COMPANY Cellulose Products Department, 916 Market Street, Wilmington, Del.

READY! Positioning stud in heelcap. Five colors identify different loads.

LOAD! Loading Driver. Triple safety device prevents accidental firing.

FIRE! Driver requires no auxiliary power, has minimum recoil.

MOLDABILITY
SHOCK RESISTANCE
DIMENSIONAL STABILITY
LIGHTWEIGHT
COLORABILITY

HERCULES Cellulosic Plastics

*TRADEMARK

Plastic heelcap molded with Hercocel E by Consolidated Molded Products Corp., Scranton, Pennsylvania, for Industrial Tool Division, Remington Arms Company, Inc., Bridgeport, Conn.

CP51-7

LATE MOLD DELIVERIES

It is so easy for a molder to promise quick deliveries on molds. He gets the order and when the mold comes in late there is nothing for the customer to do but accept the situation.

It makes it hard for the molder who promises the delivery as he sees it—and loses the job.

You can't blame the customer, he grabs at any straw and hopes for the best. After all, the quick guy may be right.

There are few shortcuts in mold making that don't cause pain later. A good workable mold takes time and care.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540

SPECIFICATIONS

Number of screws	3
Diameter of screws	4.33/4.92
Average output	200 lb./hr.
Motor	
horsepower	18
speeds . . variable from 6 to 18 rpm	
Shipping weight (approx.)	6512 lb.
Floor space	
extruder	3'2" x 8'2"
control panel	2'3" x 2'3"
Hopper feed . . fully automatic, rotating type . . . geared screw speeds	
Lubrication . . . forced-feed to all gears and bearings	
Foundations	none required

Chalk up another *first* for Windsor's! This time, the phenomenal triple-screw R.C. 200 extruder. As a direct result of its revolutionary triple-screw construction, found in no other extruder, the R.C. 200 performs every conceivable extruding job better . . . sets new records for thorough mixing of ingredients . . . for volume output (200 pounds per hour) of precision finished extrusions, and compounded and colored molding materials.

Compact, short-barreled, the substantially built R.C. 200 is powered by an 18 hp drive, and is almost entirely free of vibration during operation. In addition to molding pellets, which are produced directly in a single pass from unmixed resins, colorants, plasticizers and fillers, the R.C. 200 extrudes wide sheeting, cross sections, belting and unusual crosshead extrusions. *Details furnished promptly upon request.*

Note: Other extrusion models available are the R.C.65 Twin-Screw (65 lbs. per hour) and the R.C.100 Twin-Screw (100 lbs. per hour).

SERVING THE WORLD'S PLASTIC INDUSTRY

All inquiries for the British Empire and South America (Brazil excluded) to . . .

MANUFACTURERS
UNDER I.M.P. PATENTS

16 FINSBURY SQUARE, LONDON, E.C.2, ENGLAND

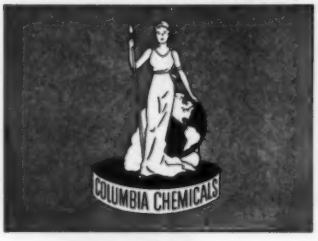
Telegrams: **TECHNIMACH FINSQUARE, LONDON** ***Cables:*** **TECHNIMACH LONDON**

Now serving your needs as .

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

You've known these familiar trademarks...

COLUMBIA CHEMICALS



SOUTHERN ALKALI

NOW look for THIS TRADEMARK to assure the same high quality in alkalies and related chemicals . . .

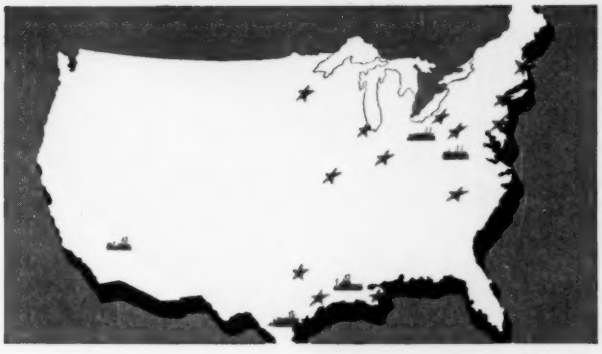
A wholly-owned subsidiary of
PITTSBURGH PLATE GLASS COMPANY

You can rely

on the same experienced organization

Whether you've been accustomed to doing business in the past with Columbia Chemical Division of Pittsburgh Plate Glass Company, or with Southern Alkali Corporation, you'll continue to find the same competent personnel—in every department—welcoming the opportunity to serve you as Columbia-Southern . . .

THROUGH STRATEGICALLY LOCATED PLANTS AND OFFICES



Production at all plants is being maintained at the highest possible levels in order to help meet the current requirements of industry.

And the same district offices will continue to provide facilities that assure the most careful attention to the needs of your business.

COLUMBIA-SOUTHERN

CHEMICAL CORPORATION

Subsidiary of Pittsburgh Plate Glass Company

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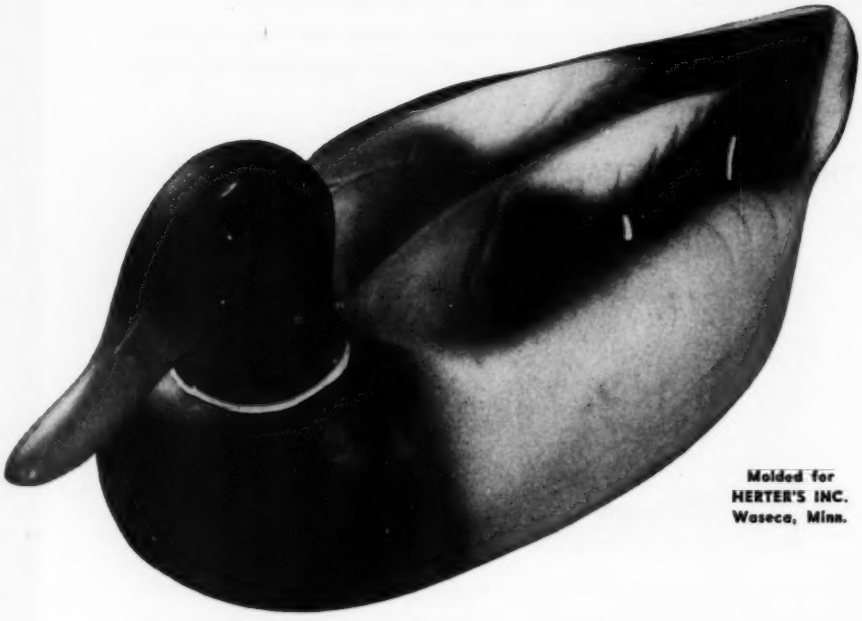
I'M THE *REAL DECOY!*



Molded for
HERTER'S INC.
Waseca, Minn.

The original model for this plastic decoy was carved by a nationally famous expert on water fowl. All of the fine detail was then carefully duplicated in the injection molded product. This amazingly life-like decoy is durable, light in weight and economically produced.

We would welcome the opportunity to work out your particular plastics problem.

INJECTION MOLDING
MINCOR
"YOUR PLASTICS DEPARTMENT"

MINNESOTA PLASTICS CORP.

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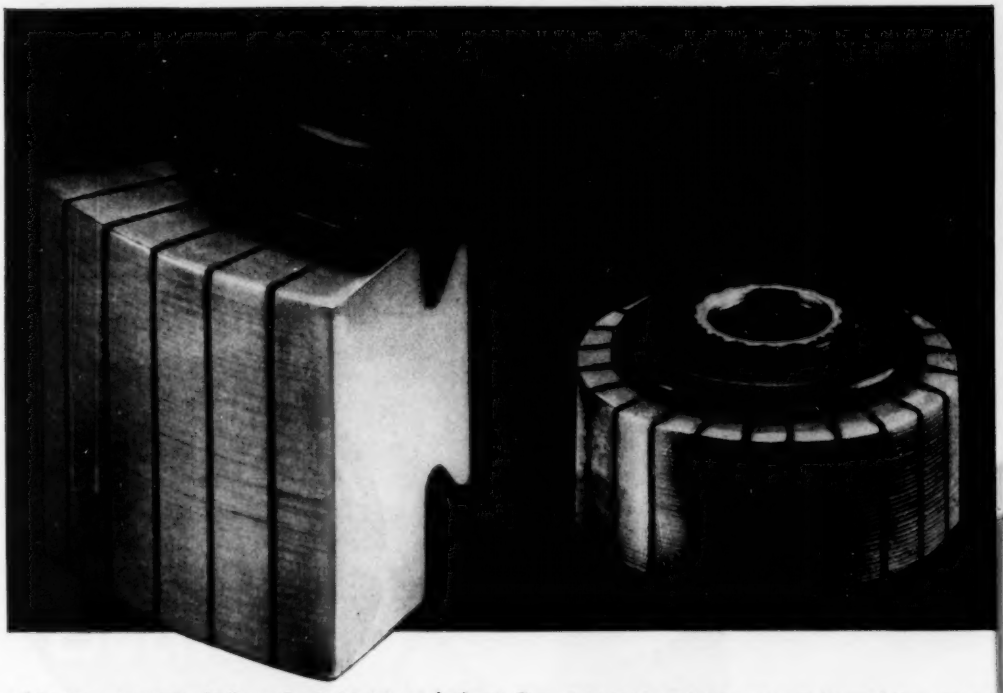


YOUR ANSWER TO HIGH-VOLTAGE PROBLEMS IN PHENOLICS!

Switch to Borden's DURITE.

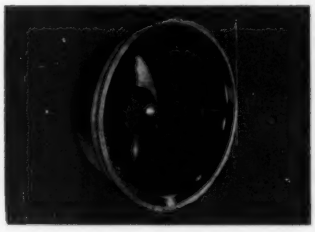
At your service are Borden engineers to specially compound DURITE to embody any of your special requirements.

Suppose you need electric motor parts like those above. The special requirements were severe . . . high dielectric strength (even at elevated temperatures) and heat resistance, to meet Gov't Specification MIL-P-14A (NFG) . . . moisture-and-oil-resistance . . . high impact-and-tensile-strength . . . minimum shrinkage to easily accommodate inserts built into these parts. RESULT: Borden's DURITE HR350 . . . a perfect blending of these vital features.

In DURITE, Borden gives you the special properties you need, in the degree you want, by skillful combining of cellulosic, carbonaceous and mineral fillers with the resin base. Be sure to address your molding problems requiring Phenolic Molding Compounds to The Borden Company, Chemical Division, Dept. MP-101, 350 Madison Ave., New York 17, N.Y.

Borden's DURITE

Molding Powders • Bonding Resins • Cements



Improved impact coupled with good heat resistance are special properties of the Borden's DURITE phenolic used in this diamond wheel core.

Smooth finish, toughness, dimensional stability are special properties of the Borden's DURITE phenolic used in this reel.

Highest impact, good finish, uniform density are special properties of the Borden's DURITE phenolic used in this gun grip.

THE molding industry finds new uses every day for vinyl plastisol. This soft plastic is rapidly gaining popularity in the industry. Its characteristics include permanent flexibility, good chemical resistance, excellent durability, brilliant colors, light fastness and ease of handling. The field is wide open—limited only by the ingenuity and imagination of the fabricator.

The Watson-Standard laboratories are well known in the field of compounding vinyl plastisols. We welcome the opportunity to work with you on any particular idea or project.

• *Write for your copies of our Technical Papers "Vinyl Organosol and Plastisol Dispersions" and "Slush Mouldings"*

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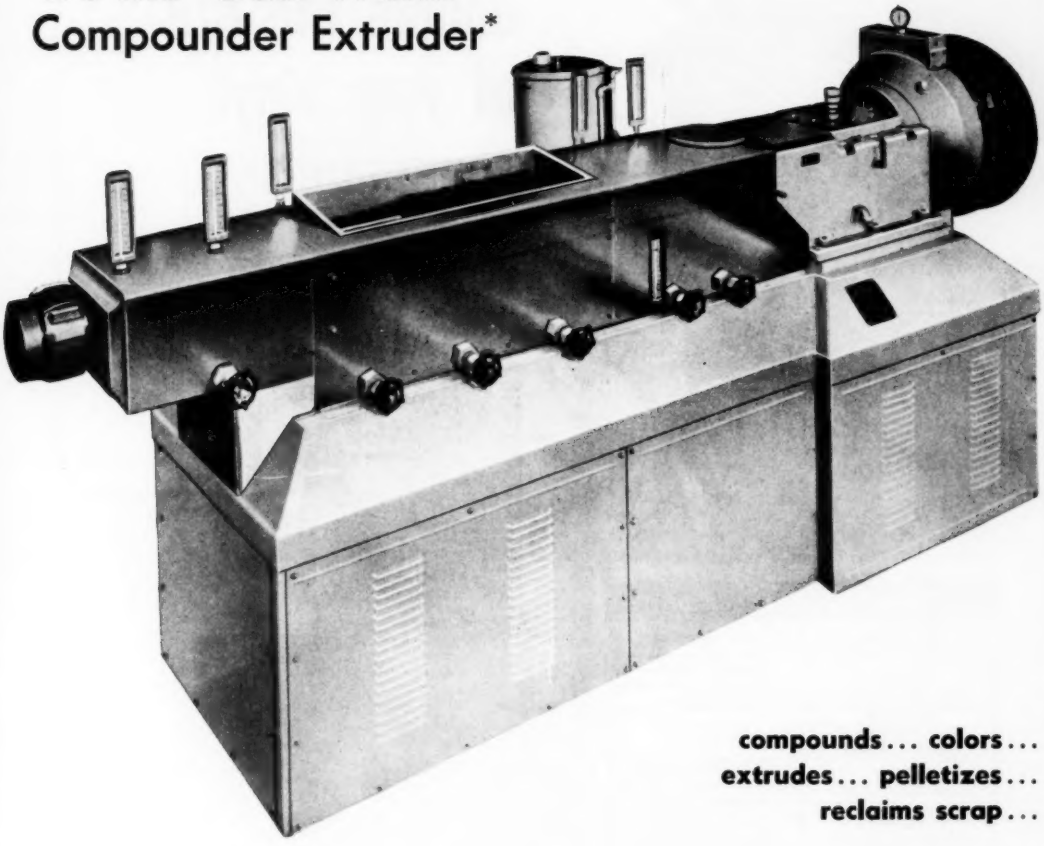
PLASTICS • INDUSTRIAL FINISHES • CHEMICALS

DO 5 JOBS ON THIS 1 MACHINE!

It's the "Dual Worm" Compounder Extruder*



compounds... colors...
extrudes... pelletizes...
reclaims scrap...

HERE is an extruding machine to slash your production costs by doing the work of five separate kinds of equipment.

The patented interacting "Dual Worms" that operate in a "pressurized" cylinder provide the explanation. They generate so much power, work so fast and knead so thoroughly that they're able to perform functions beyond the capacity of most conventional extruders.

Operation of the machine is simple and almost entirely automatic except for feeding raw materials or scrap into the hopper.

The "Dual Worm" Compounder Extruder is available with 2" worms—output approximately 100 pounds per hour. Larger, higher capacity units are in prospect.

Write today for prices and free descriptive brochure.

SMART & BROWN (Machine Tools) LTD.

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* By agreement with Messrs. WELDING ENGINEERS, Norristown, Pennsylvania, U.S.A., Smart & Brown (Machine Tools) Ltd. are the licensed manufacturers in England of 2" "Dual Worm" Compounder Extruders. They are also the sole distributors for all countries except North America. Local agents are being appointed.

You can double the life of your vinyl compounds . . . with DYPHOS

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat-stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Di-basic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability

Dutch Boy* CHEMICALS

*Reg. U. S. Pat. Off.

Greatly increased service life for your opaque vinyl products—unequalled light- and heat-stability—excellent color retention—lasting flexibility . . . these are advantages of stabilizing with "Dutch Boy" DYPHOS.

"Dutch Boy" DYPHOS is effective in upgrading quality because it has all four properties of the ideal stabilizer:

(1) Acid acceptor; (2) Reactive molecule; (3) Anti-oxidant; (4) Ultra-violet light screening agent.

This is shown by accelerated tests in the laboratory and by actual exposure tests.

Most vinyl formulations with DYPHOS show a *useful life at least twice* that of similar compounds using other stabilizers.

DYPHOS is recommended for high-quality vinyl compounds, including plastisols; also for systems using chloroparaffins as secondary plasticizers.

For complete factual data on DYPHOS and other "Dutch Boy" chemicals . . . for technical assistance in evaluating their use in your operations . . . write us.

NATIONAL LEAD COMPANY
111 Broadway, New York 6, N. Y.

for molding efficiency

DE MATTIA 4-OUNCE VERTICAL

This highly efficient vertical injection molding press is designed so that it can be used for compression and transfer work by making a few low cost additions. All hydraulic, it features smooth fluid power for both injection and mold clamping operations.

DE MATTIA VERTICAL MODEL G1

SPECIFICATIONS

Ounces Molded per Shot — 4 (Styrene) • Pounds of Plasticized Material per Hr. — 50 • Capacity of Feed Hopper (Lbs.) — 50 • Diameter of Injection Plunger — 1⅞" • Diameter of Hydraulic Injection Cylinder — 8½" • Pressure on Material — 20,500 lbs. per sq. in. • Size of Die Plates — 14" x 23" • Mold Opens — Stroke — 15" • Max. Daylight — 19" • Min. Die Space — 4" • Motor — 20 HP @ 1,200 RPM • Pump Capacity — 54 GPM @ 1,000 PSI • Mold Closing Pressure (Tons) — 150 • Floor Space Required — 47" x 59" • Height Over All — 108" • Approximate Wt. of Machine (Tons) — 4¼" • Injection Piston Stroke — 7¼" • Closing Cylinder Bore — 8 1/16" • Complete Injection Time (Max.) — 1.88 Sec. • Heating Cylinder — 4,350 Watts.

Ask **FOR YOUR COPY OF THE NEW CATALOG NOW**

The new De Mattia Catalog contains complete data on both Vertical and Horizontal De Mattia Presses. Also included is full information and specifications on compact, high capacity De Mattia Granulators and Scrap Grinders.

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YOU DON'T NEED METAL INSERTS

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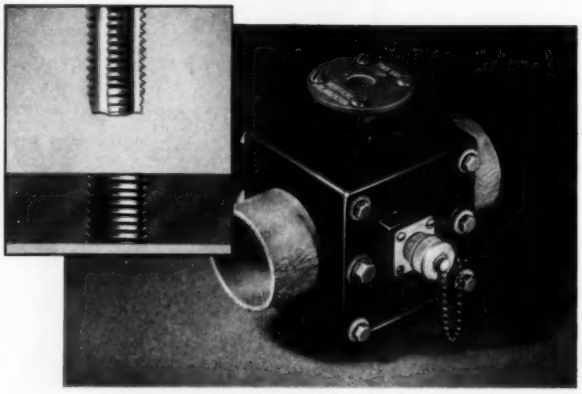
Tap Rogers Phenolic Fiberloys at High Production Speeds and Get Clean, Strong Threads.

Or Use Self-Tapping Screws and Be Sure Of a Firm, Non-Cracking Grip.

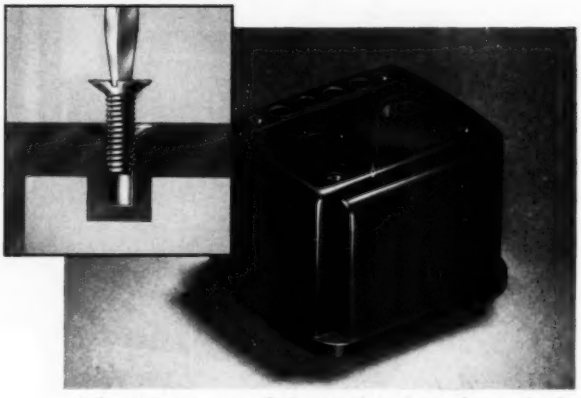
You can eliminate metal inserts in many of your molded parts by using Rogers impact phenolics. You'll save money, speed up your molding operations, and reduce some supply headaches.

Rogers materials can be used in two ways: as diecut inserts in place of metal, with general purpose phenolics, or for the complete part if high overall strength is required.

Various grades of Rogers impact phenolics are available to meet specific requirements. If you have special problems, Rogers can develop a made-to-order material. We specialize in special formulations.



Antenna mast of Rogers impact phenolic tapped at high speed for machine screws.



Self-tapping screws are firmly secured in Rogers impact phenolic transformer housing.

Better Parts for Better Products

ROGERS
CORPORATION
Established in 1832

ADDED FACTS ABOUT ROGERS IMPACT PHENOLICS
CORPORATION

FAST CURING	Impact strength is combined with flexural strength.
EASY TO MOLD	Bulk compounds can be automatically preformed.
LOW BULK FACTOR	Sheet compounds can be diecut into preform blanks for molding.

EASY-READING BOOKLET Please write for "Here's Rogers and Its Fiberloys." Dept. P, Rogers Corporation, Manchester, Conn.

MILLS PLASTIC Bottles
shape up to build product sales

CUSTOM BOTTLES—Give free play to your imagination in planning the use of custom shaped ~~CHILD PLASTIC~~ BOTTLES for your products. By combining our engineering and molding skill with our exclusive patented process, we can produce bottles in a surprisingly wide variety of shapes and sizes—and in virtually endless colors. We also make closures and atomizers to your special needs.

STOCK BOTTLES—Feather-light Polyethylene stock bottles are available in two styles: Mills "Cylinder" in 2-4-6-8 ounces; Mills "Oblong" in 2-4 ounces. Both styles are available in natural Polyethylene or your preferred color. Atomizers, closures and tubing are also available in stock styles and sizes.

Let us or our sales agent show you how we can create product selling bottles for you today.

Manufactured under Patent No. 2,515,093. Other patents pending.

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Shaped Panels

CUSTOM MOLDED OF Plastics BY MPc

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If your production program is hampered by hard-to-get metals, *investigate plastics.* Forget yesterday's limitations on the use of plastics! Amazing new molding materials and reinforcing materials now produce plastic parts of far greater strength. On **MPc** giant size presses, these materials can be molded in great weight over large areas.

For large panels, plastics are decidedly more than a mere substitute for metals. Highly complicated shapes can be molded in a single, economical operation. Plastics add attractive color and sleek, mold-perfect finish...eliminate subsequent finishing operations. Holes, studs or metal inserts can be molded in to speed assembly. Special molding materials may be used to contribute special properties...resistance to heat, oil or moisture, electrical insulation, dimensional stability, etc. In converting from metal, existing metal forming dies can sometimes be adapted to plastics molding.

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FREE "Data Book of **MPc** Facilities," an engineering-eye view of **MPc** press capacities and other production facilities... together with a survey of **MPc** special skills available for your use. *Write for your copy.*

PLASTICS DIVISION
MOLDED MPc PRODUCTS
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New Horizons IN PLASTICS

New horizons in plastics for the refrigeration industry include complete one-piece moldings of door-liners and inner-liners.

World War II moldings were limited by the then-largest 6-ounce press. Today, Amos' 300-ounce giant will achieve military results heretofore unmatched in injection molding history.

Full-size coffee and utility tables of charm, beauty and distinction can be molded by Amos' new, world's largest equipment with 6 by 4 foot mold and 1500-ton clamping pressure.

Now . . . YOU CAN RE-APPRAISE your plastic requirements —civilian or military—in terms of AMOS' new 76-ton giant molding machine . . .

YOU CAN FORGET yesterday's limitations and set your sights on *brighter, wider product horizons* with . . . 300-ounce machine capacity . . . 4 x 6 foot mold . . . 1500-ton clamping pressure . . .

AMOS ALSO BRINGS YOU the combination of *ingenuity, experience* and *facilities* which are required to produce *new applications.* And you can depend on AMOS to handle your *complete* job in plastics—DESIGN, ENGINEER, TOOL, MOLD and FINISH—*undivided* responsibility all under one roof.

YES, THE RIGHT ANSWER to *your* plastic problems can be quickly attained—just SELECT AMOS for the *finest* in Custom Injection Molding.

Phone, wire or write: **AMOS MOLDED PLASTICS**
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Amos MOLDED PLASTICS...

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IS WOVEN INTO YOUR FUTURE!

As the world's largest manufacturers of glass cloth, we are in the unique position of having studied the characteristics and qualities of glass cloth as well as its uses and potentials since its introduction as a commercial product.

Our trained technicians, engineers and designers are at your disposal for the purposes of experimenting and furthering the progress of glass cloth as well as analyzing its applicability to *your* products' needs.

We cordially invite you to utilize our services . . . feel free to bring your problems to us . . . we will be glad to help you develop your future markets.

HESS, GOLDSMITH & CO., INC. 1400 Broadway, New York 18, N.Y.

WEAVERS OF FINE FABRICS FOR OVER 66 YEARS

straight to the point

MAKES TOMORROW'S LARGER PLASTIC

J-C 200 OZ. PRE-PLASTICIZING PRESS . . .

FIRST INJECTION MOLDING MACHINE

CAPABLE OF PLASTICIZING 1000 POUNDS

OF STYRENE PER HOUR

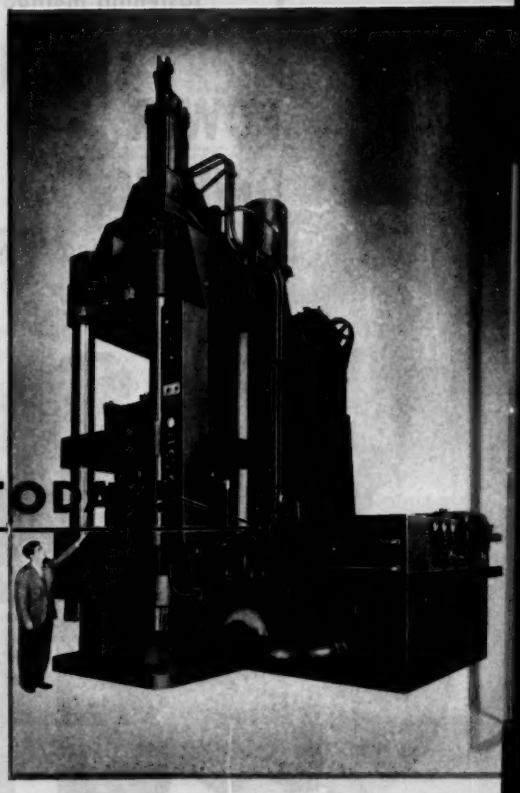
ON A CONTINUING BASIS!

J-C 200 OZ. PRE-PLASTICIZING PRESS

Household furniture, complete lighting units, display fixtures, industrial parts . . . the larger plastic products of the future are made *today* on the J-C 200 oz. pre-plasticizing press.

Utilizes frictional heat in conjunction with resistance heat to supply constant viscosity material rather than erratic temperature material to the injection chamber. Results in more projected area per ton clamping pressure . . . more strain-free moldings . . . less scrap! Permits coloring and molding in one operation. Injects uniformly plasticized material directly into the mold without torpedoes, auxiliary plungers or other supplementary devices

Capacity: 208 oz. of polystyrene on 30 sec. cycle. Potential capacity: 300 oz. at 45 sec. cycle with substitution of 300 oz. chamber.



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Hendry PRE-PLASTICIZING PROCESS JACKSON & CHURCH CO J C Saginaw Michigan

A PRODUCT OF

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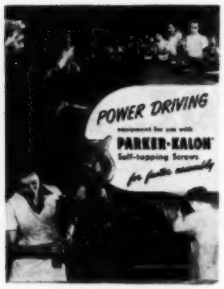
WORK WELL DONE SINCE '81

NEW P-K Bulletin tells how to add more speed to the faster fastening method



Describes and illustrates the various basic types of electric, air-operated and impact tools, as well as the automatic hopper-fed machines for screw driving in common use. Helps you determine which type is best for your assemblies. Also includes useful information on proper bit and socket selection. Free on request.

POWER DRIVING

of P-K Self-tapping Screws

This automatic, double spindle, hopper-fed machine is being used for driving two P-K Type U Hardened Metallic Drive Screws simultaneously in a plastic wiring device.

To meet America's colossal production requirements . . . for defense, for civilian goods . . . even more speed is needed in operations that have already set time-saving records.

Fitting right into this urgent need for *more speed, more efficiency*—in assembly operations—is the ever-wider use of Power Driving devices with P-K Screws.

A wide range of Power Driving equipment is available for use with the various types of P-K fasteners—and with slotted, Phillips recessed, and hex head styles. And all types have this in common—a substantial reduction in assembly time and cost.

Parker-Kalon does not manufacture power-driving equipment, but has tested many devices in the P-K laboratory under production line conditions, and found them suitable for use with P-K Screws. The information contained in the "Power Driving" Bulletin is based on reports of these many tests.

For specific information on power driving applied to your assemblies, talk to a P-K Assembly Engineer. Your P-K Distributor will furnish a copy of the Power Driving Bulletin . . . ask for Form No. 401. Or write: Parker-Kalon Corporation, 200 Varick St., New York 14.

IF IT'S P-K IT'S O.K.

The Original

PARKER-KALON® SELF-TAPPING SCREWS

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

MPS-500

an important new plasticizer for vinyl compounds

Low cost and desirable properties make MPS-500 an attractive plasticizer for vinyl compounds.

MPS-500 is a stabilized, chlorinated fatty acid ester. It shows excellent compatibility with vinyl chloride polymers and copolymers, and exerts a strong plasticizing action on them.

It is flame-retardant; has excellent low migration characteristics, and imparts very good electrical properties.

Compositions containing MPS-500 show good flexibility at ordinary and low temperatures, good all-around mechanical properties and good processing characteristics.

Particularly valuable is the high permanence of the compositions, showing very low plasticizer loss on heating and on extraction with water and oil.

Used alone, MPS-500 compares closely with tricresyl phosphate in efficiency. However, it is superior to the latter in low-temperature flexibility. Its use with other plasticizers makes possible a wide range of desirable properties.

SEND FOR THIS NEW BULLETIN

BULLETIN 35 contains properties of MPS-500; comparisons with other plasticizers; effects of aging by heat, water and gasoline; recommended stabilizers; and typical formulations and uses. Write today, on your company letterhead, for a copy.

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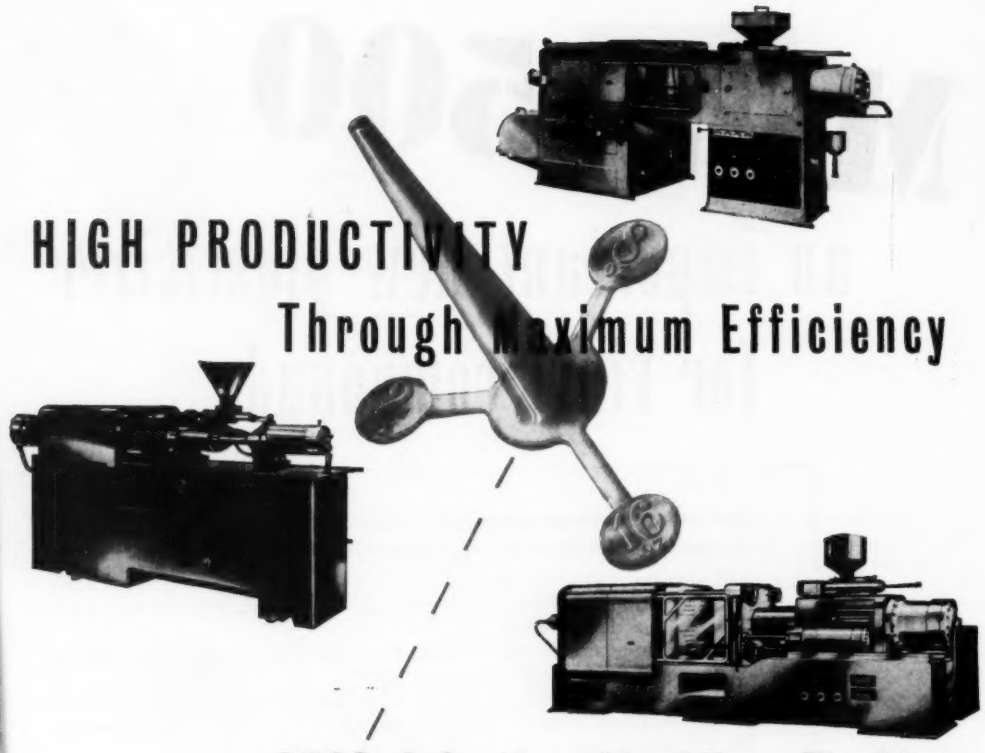

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Through Maximum Efficiency

PECO Injection Moulding Machines

The Projectile & Engineering Co. Ltd. manufacture a range of Injection Moulding Machines from 2 oz. to 16 oz. capacity, designed to meet the most exacting requirements of the Plastic Industry. They are self-contained with automatic cycle, and hydraulically operated. They have a high plasticising capacity and rate of injection. Mould-locking pressure and platen area enable them to operate at a high rate of production.

MOULDS

PECO MOULDS. Expert Designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if desired. An important side of the Company's work is the hobbing of cavities for moulds and medallions — the plant includes a 3,000-ton Hobbing plant. Master hobs to customers' samples made as required.

Full particulars of our range of Injection Moulding Machines and Moulds will be sent on request.

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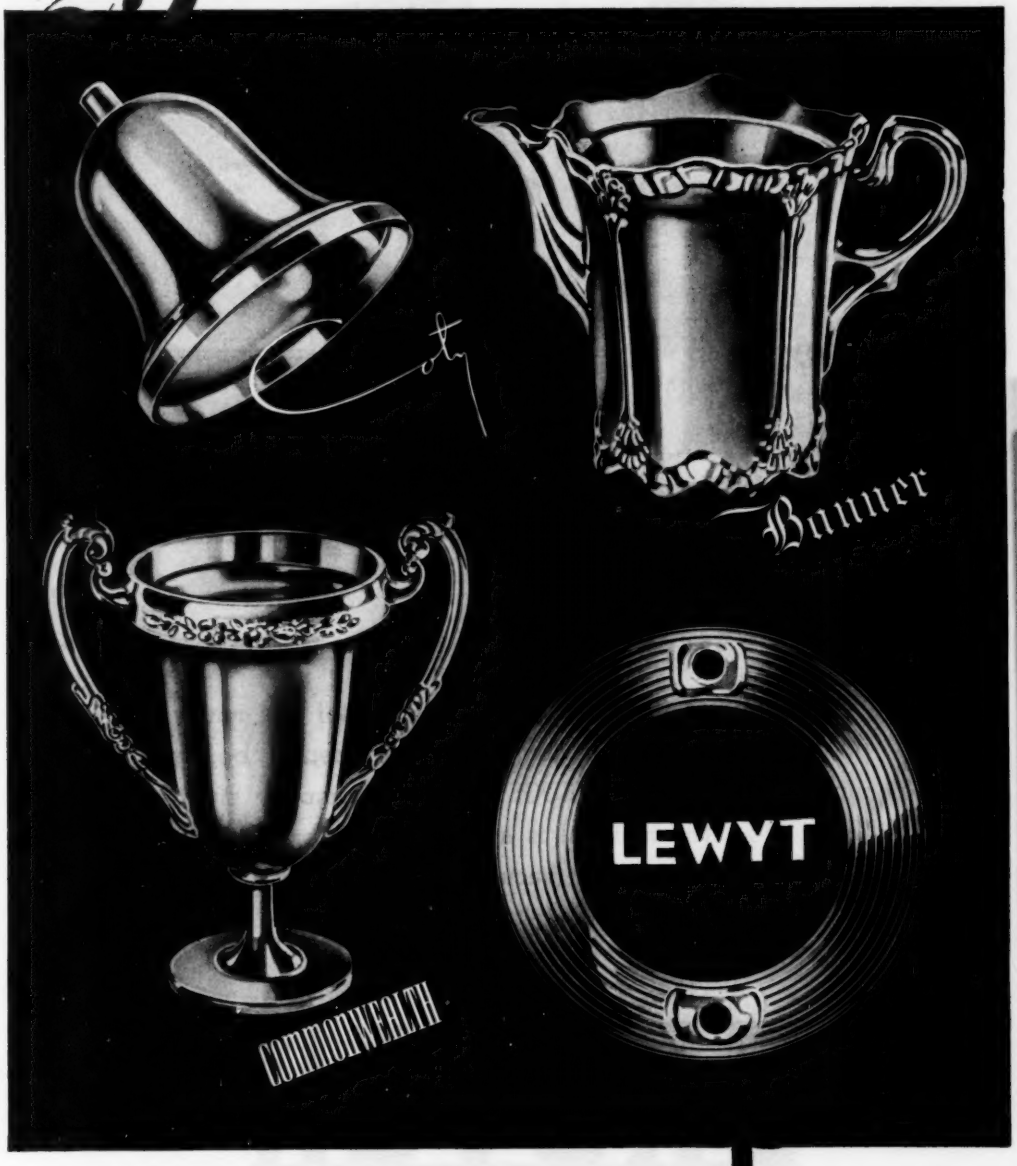
The PROJECTILE & ENGINEERING
COMPANY LIMITED

ACRE STREET, BATTERSEA, LONDON, S.W.8, ENGLAND

Telephone: Macaulay 1212 Telegrams: "Profectus, Claproad, London" Cables: Profectus, London

2.3 million metallized plastic parts in 1951



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CORPORATION

Long Island City
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CUSTOM MOLDING

The above illustration shows some of the many plastic decorated sign components currently being produced for the ANHEUSER-BUSCH Company of St. Louis, Mo. The material is acrylic and decorated with lacquers and 24K gold (vacuum distillation.)

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or

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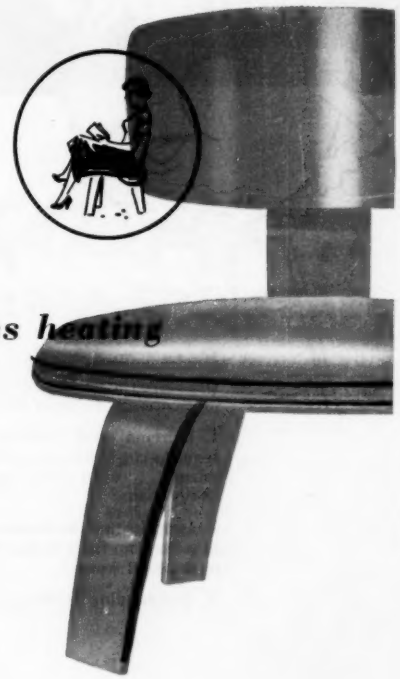


Dowtherm

means accurate control in process heating

Because DOWTHERM® heating means precision control, constant temperatures and uniform heat application, it makes possible new processes and new products.

In the plastics industry, DOWTHERM, used in molding plastic and rubber products, has improved product quality and reduced operating costs. Many production methods otherwise impossible can be utilized with DOWTHERM heating.

DOWTHERM speeds the heating cycle and at the same time reduces labor costs. Its outstanding characteristic is the accurate control it affords in obtaining temperatures between 300 and 750° F. at low pressures.

Are you fully acquainted with DOWTHERM's higher operating efficiency? We welcome the opportunity to discuss any process heat problems you may be confronted with. Write to Dept. DO 6A.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

SPEEDS HEATING • IMPROVES PRODUCTION

DOWTHERM

DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY AND AGRICULTURE

NEW

SHELL INDUSTRIAL

bring greater under extreme

FOR GEARS...

SHELL MACOMA OILS

FOR ENCLOSED GEARS, Shell Macoma Oils solve the problem of extreme pressure lubrication with *seven distinct advantages:*

1. Extreme load carrying capacity . . . remarkable ability to prevent wear and seizure . . . even after long periods under heavy load.

2. Long-lasting oxidation stability . . . plus freedom from sludge formation in the presence of water.

3. Outstanding adhesion . . . maximum protection against rust, and against leakage through worn bearings and seals.

4. Non-corrosive . . . will not cause corrosion of steel or alloy bearings.

5. Non-Foaming . . . Shell Macoma Oils successfully overcome the tendency to foam caused by aeration of oil in the gear chamber.

6. Speedy water separation.

7. Complete stability in storage and in service . . . no tendency to separate, even in extremes of heat and cold.

SHELL

Be sure to get all the facts about these new Shell Macoma Oils. Check the coupon and attach to your letterhead for full information.

Two great new products of

EP LUBRICANTS

safety to gears and bearings
loads and adverse conditions

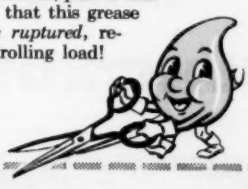
FOR BEARINGS...
SHELL ALVANIA EP GREASE

FOR GREASE-LUBRICATED bearings, Shell Alvania Grease . . . the one grease that serves *all* grease applications in the majority of plants . . . *now is available with EP qualities added! . . . now even more Multi-Purpose.*

All of these unique advantages of Alvania Grease are therefore available for the first time to operators of machines subject to extreme bearing pressures:

1. **Higher mechanical stability** than any conventional grease at operating temperatures.
2. **Pumpable at low temperatures** . . . even through centralized lubrication systems.
3. **Stable at high temperatures** . . . no phase changes—still a grease at high temperatures—still a grease upon cooling.
4. **Resistant to water** . . . won't wash out.
5. **Longer service life** . . . reduced consumption.

Shell Alvania EP Grease is the answer to some of the toughest lubricating problems in industry. In rolling operations, for example, operators of steel, rubber, plastic and paper mills report that this grease film *just won't be ruptured*, regardless of shock rolling load!



Check the coupon and mail today for additional information about Shell Alvania EP Grease.

Shell Oil Company
50 West 50th Street, New York 20, N. Y.;
or 100 Bush Street, San Francisco 6, Cal.

Please send available data on

☐ Shell Macoma Oils ☐ Shell Alvania EP Grease

Name_____

Company_____

Title_____

Address_____

SHELL OIL COMPANY

What's the "Rub" in your Rubber Products Problem?

...Perhaps Flintkote Research and Development have found the answer to your special needs, too!

Sometimes, in adhesives, coatings or sealers, *just a little difference makes all the difference in the world.*

And, finding that important difference may give you exactly what you are looking for in fabricating, compounding or processing. We have done just that for many manufacturers.

But first of all, investigate Flintkote's wide line of both aqueous and solvent types of compounds: cements, sizings, laminates, saturates, coatings and sealers. We may well have the product you need.

If not, if your requirements *do* turn out to be extra special—our trained research staff will welcome the opportunity to work with you—whether you want drum or carload quantities . . . rubber and resin formulations. Simply *write:*

THE FLINTKOTE COMPANY, *Industrial Products Division*
30 Rockefeller Plaza, New York 20, N. Y.
Atlanta • Boston • Chicago Heights • Detroit • Los Angeles
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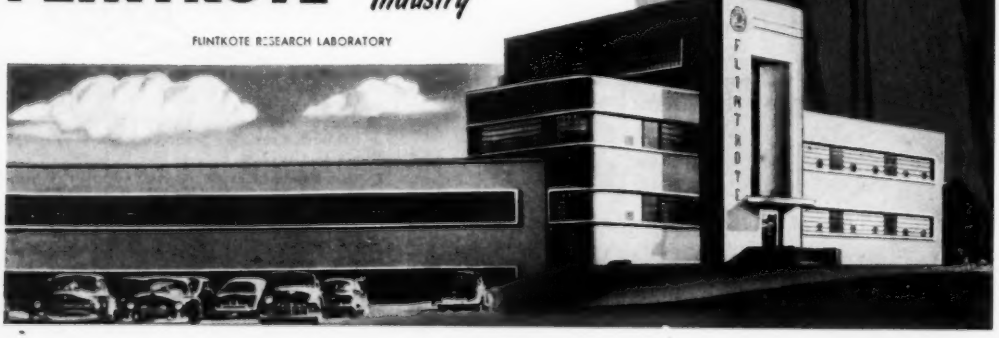
The Flintkote Company of Canada, Ltd.
30th Street, Long Branch, Toronto, Canada

FLINTKOTE *Products for Industry*

FLINTKOTE RESEARCH LABORATORY



Automatic Molding makes more parts per man-hour

Harcort Manufacturing Company of Ravenna, Ohio, makes plastic parts for famous Evenflo Nursers on ten Stokes fully automatic presses producing 15,000 parts per hour.

Products which can be made of plastic materials should be considered for their adaptability to manufacture by fully automatic molding.

Parts molded on fully automatic presses are identical and perfect because time, temperature and pressure are precisely and automatically controlled. Material savings are substantial because material is accurately and automatically metered to the molds. Investment is low because automatic presses are self-contained, requiring no costly auxiliaries. Inventories can be accurately controlled by gaging machine capacity precisely to assembly needs. Labor cost-per-piece of finished product is reduced to the vanishing-point because only one operator is required to handle a dozen or more presses.

Let Stokes experts judge from parts or blueprints if your products qualify for the high production and low labor cost of fully automatic plastics molding. Or write for a 24-page brochure on Fully Automatic Molding.

STOKES

STOKES MAKES
Plastics Molding Presses,
Industrial Tableting
and Powder Metal Presses,
Pharmaceutical Equipment,
Vacuum Processing Equipment,
High Vacuum Pumps and Gages,
Special Machinery

F. J. STOKES MACHINE COMPANY, 5504 TABOR ROAD, PHILADELPHIA 20, PA.

Yours for the ASKING

for DOING Jobs Right with Plastics!

There's a brand new "Condensed Reference File of BAKELITE and VINYLITE Plastics and Resins" just off the press . . . and available to you for the asking. Simply fill in and mail the handy coupon below.

Brief and highly detailed in its description of the various plastics and resins produced by Bakelite Company, the eight-page booklet describes dozens of interesting, economical applications of these versatile engineered materials. Fifty-six illustrations, a complete index, and a list of Bakelite Company sales offices ready to serve you are included, along with valuable technical data on physical, electrical and chemical properties.

Send for your free copy of this useful reference file at once. It may well furnish the answer to your production problems.

BAKELITE COMPANY, Dept. CQ-13
A Division of Union Carbide and Carbon Corporation UCC
30 East 42nd Street, New York 17, N. Y.

Please forward promptly my free copy of the new "Condensed Reference File of BAKELITE and VINYLITE Plastics and Resins."

*Name*_____ *Title*_____

*Company*_____

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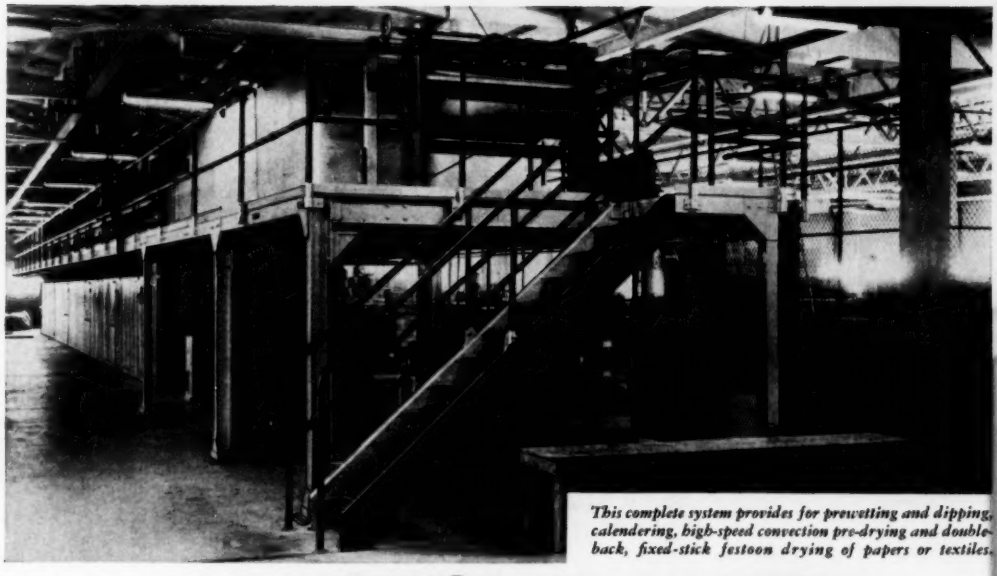
*City*_____ *Zone*____ *State*_____

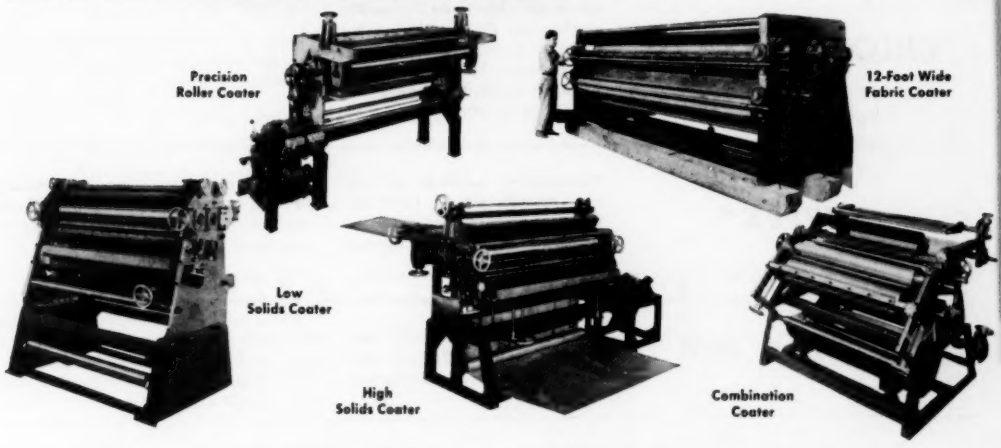
BAKELITE
TRADE-MARK
PLASTICS
TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

IOI Equipment for Coating Fabrics, Films and Foils with Organosols, Plastisols and Hydrosols



This complete system provides for prewetting and dipping, calendering, high-speed convection pre-drying and double-back, fixed-stick festoon drying of papers or textiles.



THE COATING SYSTEM and individual units shown here represent but a few examples of IOI's wide range of equipment for coating, combining and handling textiles, papers, films and foils. In addition IOI designs and manufactures letoffs, pull rolls, drying machines, system drives, etc., to augment existing equipment.

For complete information write for: "Continuous Automatic Processing Equipment", "Blueprint for Industry Part V, Coating and Handling Equipment for Textiles, Papers, Films and Foils" and "The Handling of Webs and Monofilaments."

INDUSTRIAL IOI OVENS, INC.

13825 TRISKETT ROAD CLEVELAND 11, OHIO

Chemicals you live by

DIAMOND ALKALI'S SPECIAL CHEMICALS FOR PLASTICS COMPOUNDING

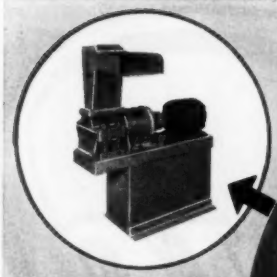
CHLOROWAX* 40	**Liquid chlorinated paraffin containing 40% chlorine by weight. Inert, nontoxic, soluble in wide variety of organic solvents.**	Highly suitable as a co-plasticizer in vinyl compounds. Lowers compounding costs at no sacrifice in quality.
CHLOROWAX* 70	**Resinous chlorinated paraffin containing 70% chlorine by weight. Cream-colored nontoxic resin. Soluble in most organic solvents. Highly resistant to burning.**	Useful as processing aid when compounded with rigid plastics, since it lowers softening point.
SURFEX*	**Precipitated calcium carbonate. Particle size 1 to 5 microns. Resin-coated. Low oil absorption (20-22 cc/100 grams).**	Useful as extender in vinyl compounds, lowering compounding costs. Contributes excellent color and light stability to organosols and plastisols.
MULTIFEX* MM	**Ultra-fine precipitated calcium carbonate. Particle size .05 to .06 microns. Uncoated.**	Used in vinyl compounds for extrusion and floor tile. Contributes improved abrasion resistance and higher gloss. Reduces compounding cost with no appreciable degradation.
KALITE*	**Precipitated calcium carbonate. Particle size about 1 micron. Oil absorption 28-32 cc. per 100 grams. Coated with 1% fatty acid.**	Used extensively in calendered 20-gauge film such as vinyl upholstery compounds. Has low oil absorption. Excellent calendering properties.

*®

DIAMOND CHEMICALS FOR PLASTICS COMPOUNDING

DIAMOND ALKALI COMPANY · CLEVELAND 14, OHIO

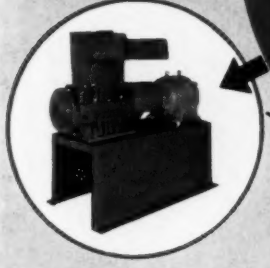
DIAMOND ALKALI CHEMICALS



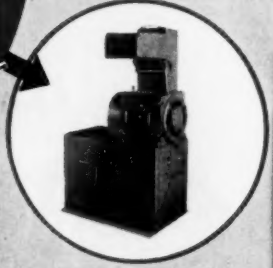
MODEL ½, DIRECT COUPLED

MODEL ½, V-BELT DRIVEN

THE GRANULATOR *YOU* NEED is made by CUMBERLAND



MODEL 10 (LARGE CAPACITY)



MODEL 10 (6" x 10" THROAT OPENING)

YOU'LL GRANULATE FASTER, CUT PRODUCTION COSTS WITH THE CUMBERLAND MACHINE THAT'S BUILT FOR YOUR JOB REQUIREMENTS

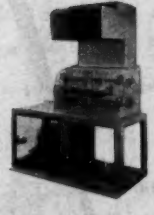
Selecting the *right* granulator for your needs is important! By choosing a machine that's best suited to *your* requirements, you'll save materials, time and money.

To make your selection problem easier, Cumberland has developed a complete line of rugged granulating machines — each designed to excel under specific job conditions. The granulator you need is among them.

Cumberland engineers — backed by a practical understanding of your problems and how to solve them — will be glad to recommend the plastics granulator that's right for you. Write for details today!

For technical information about Cumberland granulating machines, request Bulletin 250.

OTHER CUMBERLAND MACHINES



PREBREAKER

Cuts up radio, television cabinets and other large parts. Two machines available: Model 32 (20" x 32" throat opening); Model 24 (10" x 24" throat opening). Write for details.

ROTARY CHOPPING MACHINE

Heavy duty, rugged machine. Used for cutting thick vinylite slabs from two roll mills. Also used as large capacity pelletizer. Other applications are described in Bulletin 400.

CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

DEPT. 1 · BOX 216 · PROVIDENCE, RHODE ISLAND

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
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materials

CASEIN
Sheet, Rods and Tubes

CELLULOSE ACETATE
Moulding Powders, Sheets and Extrusions

POLYSTYRENE
Moulding Powders, Sheets and Extrusions

POLYVINYL CHLORIDE
Extrusions

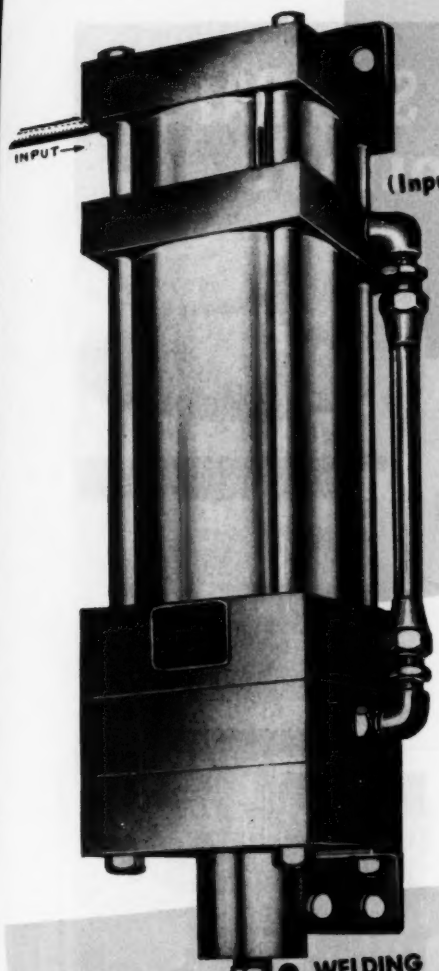
ERINOID LIMITED
STROUD, GLOUCESTERSHIRE, ENGLAND

BOOST 80 PSI AIR

(Input Range: 40 to 3000 psi Air or Fluid)

TO . . . 2000 PSI HYDRAULIC PRESSURE

(Output Range: 200 to 10,000 psi Fluid)



with Miller

Fluid Pressure BOOSTERS

From ordinary plant air line pressure, Miller Boosters produce hydraulic pressures (from 200 to 10,000 psi) for driving one or more hydraulic work cylinders simultaneously at from 30 to 450 strokes per minute. Ordinarily, the booster operates one stroke for each stroke of the operated work cylinders.

Used in place of conventional type hydraulic pumps, Miller Boosters save space and weight, permit convenient portability and are easier and less costly to install, operate, and maintain. Also, they hold pressure *indefinitely —without the motion and heat generation of ordinary pump circuits.*

Used in place of air cylinders, the booster driven hydraulic work cylinder, which can do the work of an air cylinder ten times as large and heavy, saves space and weight at point of application of cylinder thrust—since the booster itself can be mounted separately—away from the hydraulic work cylinder—and either on or off the equipment or machine.

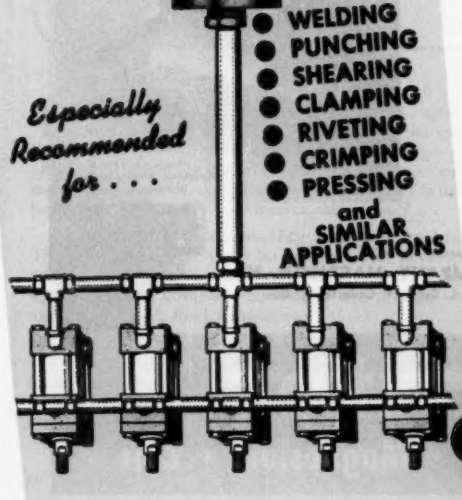
In many installations, the popular Miller Dual Pressure "Air Miser" Booster *saves up to 95% of the air* normally consumed by direct-driven air cylinders.

A wide selection of sizes, pressure ratios and mounting styles are available for the first time at low cost on a normal delivery schedule because Miller Boosters are built up from stock Miller standard cylinder parts to eliminate costly designs, patterns and castings.

Especially Recommended for . . .

- WELDING
- PUNCHING
- SHEARING
- CLAMPING
- RIVETING
- CRIMPING
- PRESSING

and SIMILAR APPLICATIONS



Full Details In Miller Bulletin B-200 Sent FREE On Reques

OTHER MILLER PRODUCTS INCLUDE: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAUUC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FO 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. A MOUNTING STYLES AVAILABLE.

Miller

MILLER MOTOR COMPANY

2020 N. HAWTHORNE — MELROSE PARK, ILL.

CLEVELAND — PITTSBURGH — PHILADELPHIA — DETROIT — YOUNGSTOWN — BOSTON HARTFORD — NEW YORK CITY — DAYTON — ST. PAUL — FORT WAYNE — INDIANAPOLIS MILWAUKEE — NASHVILLE — SEATTLE — LOS ANGELES — SAN FRANCISCO — BALTIMOR ST. LOUIS and OTHER AREAS.

Sales and Service from coast to coast

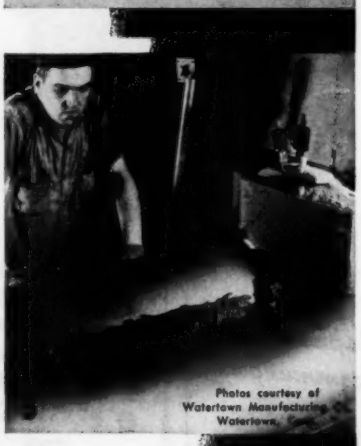
Proof that METASAP STEARATES MEAN BETTER MOLDING

Here's proof, in 3 pictures, that Metasap Stearates can help you do an excellent molding job:

Picture 1 shows a preform such as no molder wants. It was obtained during extensive tests run by the Watertown Manufacturing Company, and proved typical of a large number of preforms molded from compounds that did NOT contain Metasap Stearate as lubricant. Such preforms required an average pressure of 50 lbs. to eject them from the mold, and an unprofitably large percentage were delaminated in the ejection process.

Picture 2 shows a typical preform obtained, during the same tests, from molding compounds containing Metasap Calcium Stearate. Perfect in shape, such preforms required only 10 lbs. of pressure to release them from the mold.

Picture 3 shows how early in the manufacturing cycle the advantages of Metasap Stearates can be realized. In rolling sheets of molding compound (prior to grinding for powder) the inclusion of a Metasap Stearate aids in preventing the material sticking to the rolling mill.



Photos courtesy of Watertown Manufacturing Co., Watertown

ADD IT ALL UP—and the answer is plain:

Lubricating with Metasap Stearates assures—

Improved Preforms—without delamination . . . since high ejection pressures are unnecessary.

Improved Finished Products—clean cut, with more marketable finish.

Increased Output—Rapid, easy ejection avoids waste of time and effort—assures fewer rejects.

Increased Economy—Preform molding can be done with machines of less tonnage. Molding materials are conserved. Mold life is increased—because scoring is virtually eliminated.

Metasap Zinc and Calcium Stearates, for use in molding plastics, assure significant manufacturing economies all along the line—and better products, too. Today, when you must produce *quality* and sell *competitively* you'll find Metasap stearate lubrication an indispensable aid to more profitable operation.

For complete information, write

METASAP CHEMICAL COMPANY, HARRISON, N. J.

Chicago • Boston • Richmond, Calif. • Cedartown, Ga.

METASAP CHEMICAL COMPANY REG. U.S. PAT. OFF.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

3 Good Questions...

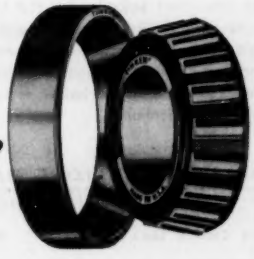
Why do TIMKEN® bearings take heavier loads and have longer life?

Why do TIMKEN bearings resist wear and retain precision longer?

Why are TIMKEN bearings more uniform in their high quality?

One Good Answer—

THE TIMKEN COMPANY MAKES ITS OWN STEEL!



THERE are several good answers to the questions above. But one of the *basic* reasons for the superior load capacity, wear resistance, and uniform high quality of Timken® bearings is the fact that the Timken Company makes its own steel. And the Timken Company is the only bearing manufacturer in America that does!

Having its own steel-making facilities enables the Timken Company to carry on research and development in steels that results in constant improvement in quality. It also permits complete control of the product—from melting through final inspection.

The high quality of Timken steel begins in the melting of selected scrap. Correct chemical composition of every heat is insured by use of the direct-reading spectrometer, new scientific instrument for analyzing a heat of steel in a matter of seconds. Even after the steel is in billet form, quality safeguards continue. The billets are scarfed and chipped to prevent cracks and flaws in the internal structure of the finished product.

Along with advanced design, precision manufacture, and rigid quality control, Timken steel is one of the big reasons why it pays to always look for the trade-mark "Timken" on the tapered roller bearings you buy. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

TIMKEN TAPERED ROLLER BEARINGS

TRADE-MARK REG. U. S. PAT. OFF.

NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST ←◎→ LOADS OR ANY COMBINATION

H-P-M *FIRST* with a complete

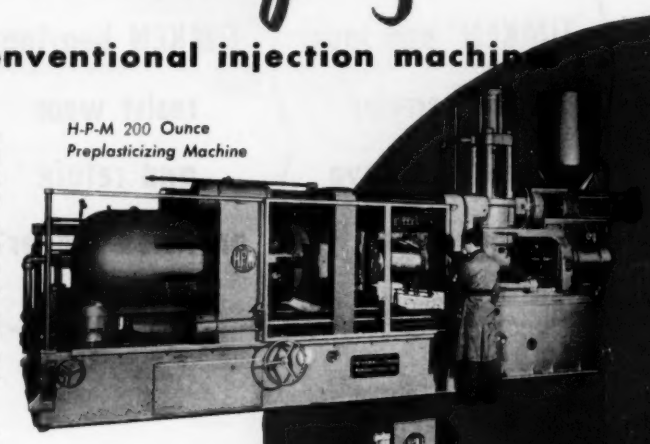
"Pre-Plasticizing"

doubles capacity of conventional injection machin

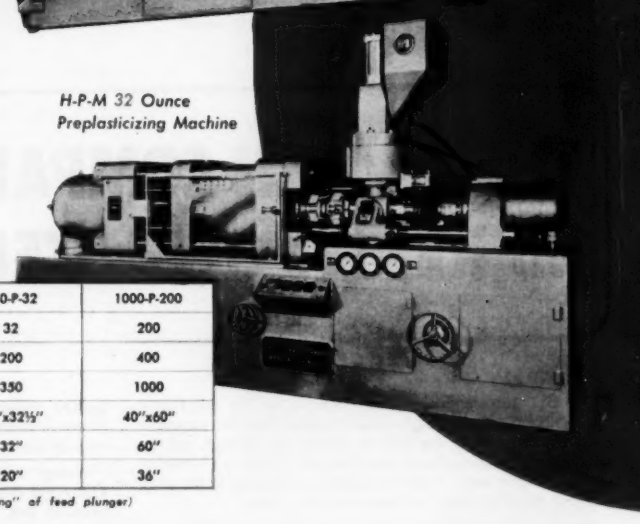
● H-P-M is first to offer injection molders the many advantages of preplasticizing on a complete line of machines, both large and small. Here's what H-P-M preplasticizing means to you: (1) Shot capacity of conventional machines has been tripled, thus increasing the versatility of machines for both large and small parts; (2) Faster plasticizing rates (more than twice that of conventional machines) means more parts per hour; (3) Lower injection pressures permit lighter weight parts, fewer strains, easier part removal from mold; (4) Lower molding temperatures (below burning point) reduce possibility of discoloration or scrap.

Yes, all these advantages which the injection molder has long wished for can now go to work for you with H-P-M's new line of "Pre-plasticizing" molding machines (See chart below). For H-P-M 9 and 16 oz. machines already installed in the field, a "packaged" pre-plasticizing conversion unit is available. And, for molders desiring conventional injection machines, H-P-M's stock line shown below, is tops! Write for complete specifications.

H-P-M 200 Ounce Preplasticizing Machine



H-P-M 32 Ounce Preplasticizing Machine



H-P-M PRE-PLASTICIZING MACHINES

Model No.	250-P-20	350-P-32	1000-P-200
* Inj. Capacity (ozs.)	20	32	200
* Plasticizing (lbs./hr.)	200	200	400
Clamp (tons)	250	350	1000
Mold Space	17½"x26"	20"x32½"	40"x60"
Daylight	27"	32"	60"
Clamp Travel	18"	20"	36"

* Polystyrene (Plasticizing rate based upon continuous "stuffing" of feed plunger)

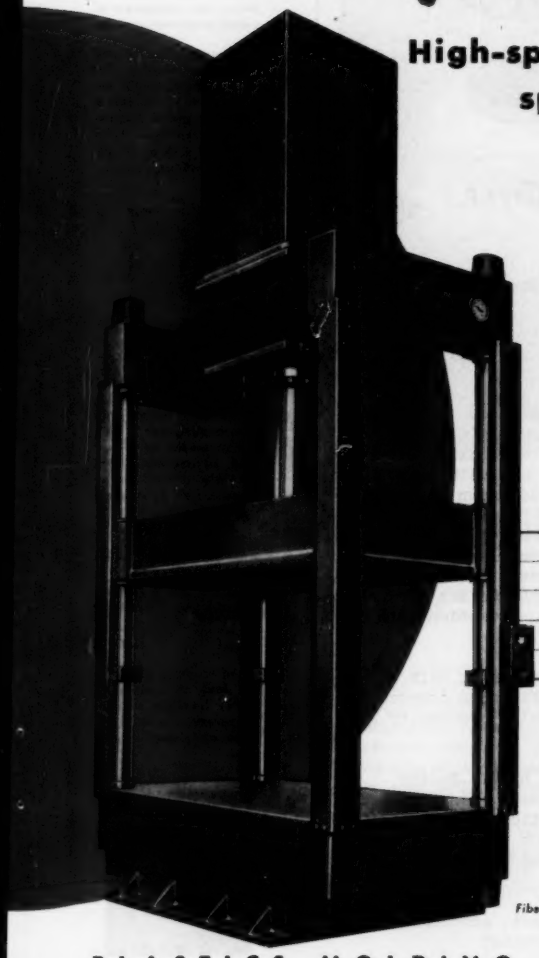
HPM . . . . THE COMPLETE LINE FOR EVERY

INJECTION MACHINE

line of stock machines for . . .

Reinforced Plastics

High-speed, precision presses designed specifically for Fiberglas molding



H-P-M's 200-Ton Fiberglas Molding Press

● You can take full advantage of the new business markets springing up from "Fiberglas" molding with H-P-M's complete line of stock presses. Developed as the result of close cooperation with Owens-Corning, (the company that fathered Fiberglas molding) these H-P-M presses meet the rigid requirements of this new molding process.

Each press is self-contained with complete H-P-M hydraulic power system and electric motor drive. Semi-automatic control—fast closing—automatic slow-downs and accurate control of pressure are but a few features in these H-P-M presses. Check the chart below for models that can be ordered to fit your production requirements. Write for copy of Bulletin 5107.

H-P-M REINFORCED PLASTICS PRESSES

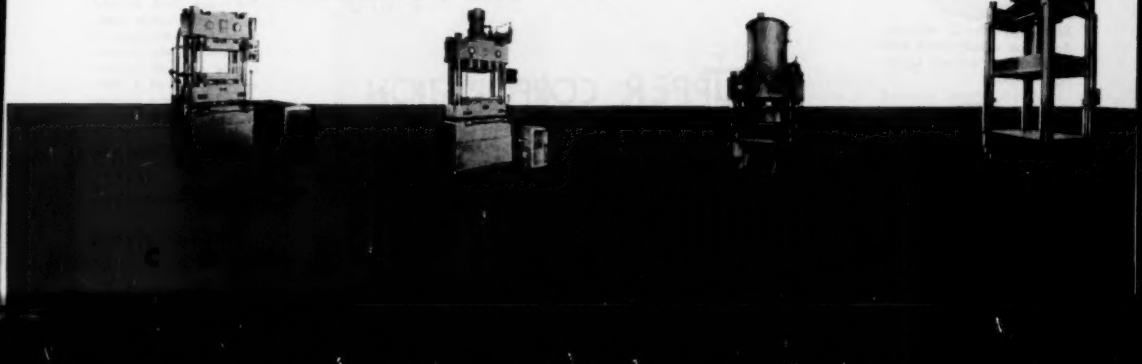
Tonnage	100	150	200
Mold Size (max.)	48"x36"	60"x48"	84"x60"
Daylight	84"	84"	84"
Stroke	48"	48"	48"
Motor HP	10	10	30

HPM

THE HYDRAULIC PRESS MFG. CO.

1010 MARION ROAD - MT. GILEAD, OHIO, U.S.A.

PLASTICS MOLDING JOB . . . .



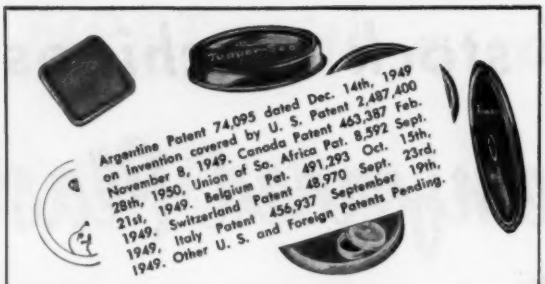
Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.


Argentine Patent 74,095 dated Dec. 14th, 1949 on invention covered by U. S. Patent 2,487,400 November 8, 1949. Canada Patent 483,387 Feb. 28th, 1950. Union of So. Africa Pat. 8,592 Sept. 21st, 1949. Belgium Pat. 491,293 Oct. 15th, 1949. Switzerland Patent 48,970 Sept. 23rd, 1949. Italy Patent 456,937 September 19th, 1949. Other U. S. and Foreign Patents Pending.

TUPPER! Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

FORMAL NOTICE! 9th November, 1949

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Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

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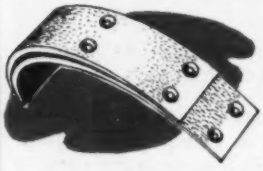

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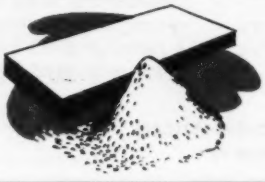

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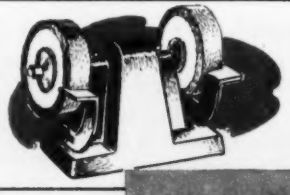

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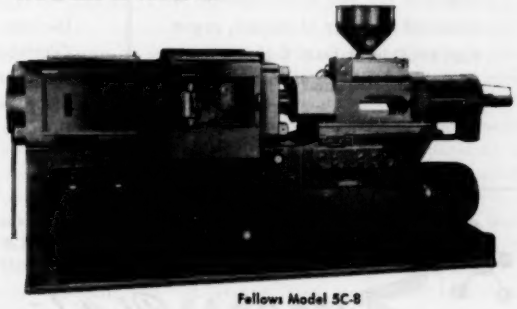

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Modern Plastics BULLETIN

September 19, 1951

More Styrene For Rubber?

Just when it seemed as though the styrene and rubber situation was about to quiet down and that a fairly good supply of styrene monomer would be available for plastics in both the near and distant future, Senator Lyndon Johnson's watchdog committee threw a bombshell into the proceedings with a request which would seem to indicate that the Government should increase GR-S production from its present rate of 760,000 tons a year to an implied 960,000 tons. The program had already been set up to raise production to 860,000 tons in 1952, but the extra 100,000 in brand new capacity is something of a surprise. Indeed, before the Senator let loose his committee's recommendations, there were many symptoms to indicate that even the 860,000-ton goal might not be necessary.

Do We Need More Rubber?

At this moment it is just as difficult to convince molders of a possible polystyrene shortage in 1952 as it was to convince them of an impending shortage in April or May of 1950. There are two important factors that bear on the subject: first—styrene monomer capacity will be considerably expanded in the next 18 months; second—polystyrene molders are now receiving as much molding material as they ever did (or more) but smart observers believe they could use 8 to 10 million lb. more per month in the not too distant future if all the big new presses could be turned loose on large size pieces that are now in contemplation. In other words, far-seeing executives anticipate an expansion program that may be temporarily held up by an expanded synthetic rubber program. The great point at issue is: Do we need the expanded rubber program (said to be needed for defense) or is it being used to beat down natural rubber prices, thus curtailing plastics growth?

Competitive Urge on the Decline

The average injection molder today is comparatively unconcerned about his polystyrene supply line. Not only do most of them have a sufficient supply at the moment, but the market for finished goods has been a bit slow. One of the large users recently said: "I had a great moment last week when I relaxed in my chair and turned down an offer for a carload of styrene." Unfortunately, the competitive urge has been dampened and the desire to expand has been dulled as a result of past problems in obtaining material. Molders no doubt feel that they will be happy just to be able to make more of the same thing rather than to attempt to find new markets in these uncertain times. It is difficult to persuade them even to think about it as long as the synthetic rubber program is being juggled around and is presenting a constant threat to the styrene supply line. Consequently the present conflict in government circles concerning the rubber supply is of tremendous importance to injection molders.

How Much Styrene for Plastics?

The amount of polystyrene produced in the first six months of this year was 4 or 5 million lb. more than in the similar period of 1950. Even the high-styrene butadiene compounds for paint and shoe soles were produced in greater quantity than in 1950 according to Tariff Commission figures, but demand for the high-styrene compounds is still far in excess of supply. It is quite possible that more styrene monomer will be used for plastics in 1951 than was used in 1950 despite the rubber program.

The reason is that more styrene monomer has been made available. The industry is now operating at a 700 million lb. annual rate, but will probably produce about 650 million lb. in comparison to nearly 550 million in 1950. The rate will go up in 1952, but no one knows how much in view of construction problems. A 760,000-ton rubber program will take 360 million lb. of styrene. Each additional 100,000 tons will take 40 million lb. of styrene. Consequently it isn't hard to figure that it is going to be difficult to get much more than 300 million lb. of styrene for plastics if rubber continues to expand, and that is less than the volume for plastics in 1950.

Some time ago it was announced that the 860,000-ton rubber program would start in December of 1951. Many persons thought that program would not start short of a world-wide war because they reasoned that the natural rubber stock pile was near completion, and some 40,000 to 70,000 tons per month of natural rubber might be diverted to commercial purposes in the near future. In fact, the head of the Defense Production Administration announced that rubber restrictions might even be removed in the first quarter. A former head of the Government's Rubber Project recently stated that there would be a world surplus of 600,000 tons of rubber in 1951. The current rate of consumption of new rubber in the U.S. is 1,200,000 tons, just 40,000 tons short of last year's record consumption. Yet the Senate Small Business Committee complains bitterly that the small operators in the rubber business are being forced out of business for lack of rubber.

Natural Rubber Stock Pile

The natural rubber stock pile is one of the bones of contention. Rubber experts point out that Dept. of Commerce figures would indicate that there is already 730,000 tons of natural rubber in stock pile and some 60,000 or more tons in company stock piles that would be nationalized in case of emergency. Some 150,000 or 200,000 tons is afloat on the way here. The goal is estimated to be about 1,100,000 tons; so it is time to think about an orderly decline in stock pile purchasing rather than to stop suddenly a few months hence and throw from 40,000 to 70,000 tons monthly on the free market and create complete chaos.

The Senator Says: "We Want More Rubber"

A spokesman for Senator Johnson's committee challenges practically all of these figures. He says the above stock pile figure is not large enough; implies that far more than one million tons of rubber will be needed per year in a world-wide war and that a larger percentage of natural rubber than the commonly used 25% of total consumption will be necessary because of the nature of military needs; that we must plan on a reserve to last more than four years. Another source points out that rubber from Indonesia may go on a decline any day now due to troubled economics in that country from which we are now obtaining a large percentage of our rubber. Senator Johnson says that we should definitely increase production of synthetic rubber and substitute it for natural wherever feasible.

Plastics Caught in Middle of Rubber Dispute

The Rubber Division of NPA, which governs rubber distribution, is caught in the middle between Senator Johnson's committee (which would draw tighter reins on rubber) and the Senate Small Business Committee (which would make rubber more available). In either case the plastics industry seems to be on the outside looking in and is caught in a vast whirligig of national politics, shortage of steel with which to build styrene plants, a possible shortage of benzene from which to produce styrene, and many other complex and unpredictable gyrations.

Metal for Molds and Inserts

Officials of NPA's Chemical Div. are still concerned over the apparent lack of interest shown by plastics processors in applying to CMP for metal that will be needed for molds, inserts, and reinforcements in the future. If any firm wants to use more than 5 tons of carbon steel, ½ ton of alloy steel, 500 lb. of copper, or 500 lb. of aluminum in the last quarter of 1951, he should have filed form CMP-4B with NPA in Washington. If he doesn't expect to use that much he must make application to a regional office. By mid-September, only 16 molders had applied to Washington for insert material and a scattered few for mold material. Uncertainty exists because Chemical Div. officials have no record of what molders may have done by way of filing applications with their local offices.

Future Allotments Depend on Firm's Record

The most alarming thing about failure to file for fourth quarter allotments is that it will hamper getting metal in the future, since each applicant who filed for fourth quarter allotment was given advance allotments for each quarter in 1952, based on his 1951 fourth quarter allotment. If a fourth quarter application was not filed, processors are urged to get in their first quarter request on Form CMP-4B before the Oct. 1 deadline and get themselves on record for future allotments. (Send for Form CMP-4B instruction sheet at once if you don't have it). Advance allotments for metal have been made on a basis of percentages of the amount requested for the last quarter 1951. Thus, first quarter advance allotment for 1952 would be 75%; second quarter, 60%; third quarter, 52 percent. NPA will grant any metal which becomes available in excess of that amount. There is no essentiality involved in this program except that projects involving atomic energy and two or three others which are secret will get 100% of the metal they need. Otherwise users will get a certain percentage of the metal they ask for, depending upon its availability, and we are told that availability for inserts, molds, is likely to get worse before it gets better.

Watch Out for Mold and Insert Shortage

End item producers should therefore make certain that their own requirements for molds and inserts are recorded with NPA or that their mold maker has taken care of their projected needs in his request for metal to be used during 1952. We have a hunch that there will be a lot of screaming about metal for inserts and molds in the next 60 or 90 days.

Structural Steel

The threat to the expansion of the chemicals industry caused by CMP's fourth quarter allocation of structural steel as reported in this column last month is no longer a threat. It has happened. Plants that were already under construction were not so hard hit, but many of those scheduled to start in the fourth quarter will be delayed at least three months and probably longer. Among the materials in which expansion plans will be delayed are phenol, saran, styrene, chlorine, vinyl, cellulose acetate, and both ethyl and methyl chloride which are used in the production of ethyl cellulose, silicones, and rubber.

On the other hand, plants to produce naphthalene, phthalic anhydride, polyethylene, and acrylonitrile were able to obtain at least a portion of the steel needed for their construction.

Chemical firms that need structural steel for the first quarter were urged to submit their requests on CMP Form 4C before Sept. 20—even if they are not yet in, the requests should be filed in order to be on record for second quarter allotments. Firms are advised to state clearly what they intend to produce. Use of the simple word "chemicals" is not enough. The request should state which specific chemical is to be produced, why it is essential, how it might save other materials, and how it ties into some other project that is vital to the present economy.

CMP DO Orders Pass Out

As we go to press there is every indication that the pestiferous DO orders served on the chemical industry by those who had acquired CMP authorizations will be eliminated. Under the old system, anyone who obtained CMP authorization to use steel, aluminum, or copper could issue a DO to obtain whatever materials were needed to go with it. Thus if a man could get an authorization to obtain metal for the clasp on a necklace, he could get the plastic to go with it. Vinyl to go with copper for wire coating and phenolic for electrical parts were the examples most commonly used to show how the plastics industry was affected. The effect on the plastics industry was disturbing its customer relations in that a customer's purchasing record was becoming more and more ineffective in distribution of materials: there were so many CMP DO orders that not enough material was left for unrated distribution. That is, customers with CMP authorizations could obtain material regardless of their past purchasing record, and consequently the entire chemical industry's historical distributing pattern was in jeopardy.

DO orders for the Atomic Energy Commission and the Armed Forces must still be filled ahead of any other order in the hands of a supplier, but the elimination of the CMP stuff will cut off a sizeable amount of DO business and channel more plastics back into its normal distribution pattern.

The next step in the control pattern might well be an order that would limit the amount of a supplier's material that would be channelled into military business. It would be a companion piece to M-32 which sets a limit to the percentage of a supplier's material that he must supply for DO business, but the new order would set a ceiling beyond which that percentage could not be raised. Such an order would be an effort to prevent the military from "locking up" certain materials for which they see a big future demand, but which are not yet ready to go into big production or for which replacements of more plentiful materials could be used. In effect, such an order would say: "Let's stop and look to see if something else can be done before we further gum up the supply situation in this material."

How to Get Both Bullets AND Butter

If this country is going to have a "bullet and butter" economy for an indefinite period there must be enough cream for at least the butter. Such an order would of course be abolished in case of a world-wide war when all such scarce materials would go on allocation almost automatically (and the military would get whatever percentage of the total they needed) but under present conditions there should be some limit to the amount of goods ticketed for the military. Congress, by its action on the military budget, evidently thinks that tax money for the military should be watched and limited if need be, and the same kind of reasoning might be applied to goods as well as to money.

Polyethylene Allocation

The polyethylene allocation program moved along in fairly smooth order in September, but of course not everyone could be satisfied. Available material was divided: military, 43%; essential civilian, 37%; and 20% to be divided as the supplier saw fit. There were no changes in the classification of essential civilian items as there has been in previous months. A little more material was available than in previous months, since a new plant came into partial production, and the manufacturing difficulties which had resulted in decreased production the previous months have now been overcome. But anyone who is expecting to get more polyethylene for other than military or essential civilian use should move cautiously—the Armed Forces are finding more and more applications for which they want to use polyethylene.

Vinyls in Uncertain Position

Ever since Korea, the vinyl situation has been most difficult to judge because of a multitude of changing factors that no crystal ball could possibly reveal. At present, inventories of resin, film, and sheet are high, yet producers claim they could sell from 15 to 20% more resin than is available. Nearly everyone expected that film inventories would be somewhat depleted by

heavy consumer buying in September, but that buying has not yet shown up to any great extent. However, producers feel that the buying surge has only been postponed until October, and most film calenderers are continuing to keep their inventories well built up.

Over-all vinyl resin production for the first six months of 1951 showed a tremendous increase over the first half of 1950. The approximate figures deduced from government reports are 150 million lb. in the first six months of 1950 and well over 210 million in 1951. This includes saran, vinyl butyral, acetate, alcohol, etc. Breakdown figures are not yet available, but the vinyl chloride and copolymer figure for all of 1950 was near 300 million lb.—this year it should be near 350 million. The vinyl chloride and copolymer capacity will probably be at least 400 million by the end of this year but shortages of chlorine, acetylene, and plasticizers will make it impossible to operate at that rate.

Biggest Gains in Extrusion and Molding

The most striking feature of vinyl chloride production in 1951 has been the increasing volume used for extrusion and molding resin. It has grown from around 8 or 9 million lb. a month before Korea to 13 million in June 1951, and it is now approaching the amount used for film and sheet which has been running from 12 to 15 million. Insofar as vinyl chloride is concerned, the figure must be adjusted to knock out the vinyl butyral in sheeting and saran in extruded materials. From 50 to 60% of the extrusion material is estimated to be for wire coating. With saran and wire coating deducted, the balance of this material is being used for records, garden hose, profile extrusions, welting and gasketing, and a certain amount for plastisols.

Another factor that contributed to a tight resin situation began months ago. When the consumer demand for film declined and slow furniture sales indicated that there would be a drop in demand for vinyl sheet upholstery, most calenderers kept right on buying resin to the limit of their contracts and building up inventory despite a reported consumer decline. They were confident that a vinyl scarcity and a revived consumer demand this fall would remove any surplus they could build up this summer. Some of them no doubt sold resin at the regular market price to other processors who couldn't get much resin because they didn't have a long purchasing record. This led to exaggerated stories of shortages and black market operations—of which there were some, but not of epoch-making proportions.

Still another factor that led to confusion was the wailing and complaining of some calenderers which started about May after a year of unprecedented production levels, when their operations dropped to 80% of capacity; their wails turned to groans of utter despair when production dropped off even more in mid-summer. Yet these same operators were sometimes producing almost as much film as they were a year earlier because of increased proficiency in operating techniques.

New Vinyl Products Coming to Market

On top of all these confusing elements, resin producers say that production in July and August was bigger than ever. Probably some of this resin is being used to fill supply lines, but one producer explains that resin is still tight since users who had not been able to get resin before (by virtue of a low volume purchasing record) are now obtaining material to put into products that had been held off the market until raw material became available. These are mostly industrial-type products that will add considerable poundage to vinyl usage.

DO orders for vinyl, except for wire coating, are still of minor importance, but enough development work has been done to assure a fairly large volume of vinyl for military purposes if a world-wide war breaks out in the future.

Plasticizers May Be Key to Vinyl Volume

Despite the shortage of chlorine and acetylene, it is believed that a potential shortage of plasticizers may be the controlling factor in the use of vinyl chloride for the next few months. That shortage stems back to scarcity of naphthalene, phthalic anhydride, phosphorous-oxychloride, and sebacic acid, and it may be mid-1952 before any relief is available.

The phthalic anhydride situation is about like this:

1950 production	216,000,000 lb.
First six months, 1951 ..	123,000,000 lb.
Estimated total, 1951	245,000,000 lb.
Estimated demand, 1951 .	261,000,000 lb.

It is estimated that about 80 million lb. will be needed for plasticizers in 1951, about 146 million lb. for paint, and the balance for undisclosed purposes which have priority. The demand for paint might possibly decline due to a drop in automobile and durable goods production, but on the other hand military vehicles also require the same kind of paint. Phthalic, as most readers know, is a fundamental material used in production of the most widely used phthalate plasticizers such as DOP and DIOP. Other phthlates are also widely used in production of cellulose acetate and smokeless powder.

Phosphate plasticizers which have made remarkable advances in the last two years are also threatened with scarcity because a ceiling in the supply of phosphorous-oxychloride has been reached. Sebacic acid, also widely used in plasticizers, is scarce because of other uses including its requirement in plastic-type nylon. Fatty acids, from which another type of plasticizer is made, are in fairly good supply, but they are the type which is generally used with other plasticizers and can seldom be used alone or even to extend the big volume plasticizers.

MODERN mp PLASTICS
VOLUME 29 OCTOBER 1951 NUMBER 2

Why Doctors Are Using More Plastics

Courtesy Cutter Laboratories

Injection molded polystyrene infusion barrel employed for the administration of blood during operation is attached to receptacle (suspended at upper left) containing blood

DURING the past five years, medical research has indicated that a number of plastic materials are successfully tolerated by human tissue and bone structure. Uses of plastics in the field of medicine and surgery, up to that time, had been limited largely to electrical and mechanical applications in diagnostic and therapeutic instruments and to housings for such equipment as X-ray machines, cardiographs, and the like. These recent findings open to the plastics industry a variety of new applications, and to the medical field a group of new materials for both internal and external use which, in many cases, perform with greater success than the materials which they replace. Further experimentation, still in the developmental stage, suggests the likelihood that the use of plastics will facilitate medical and surgical techniques not possible with other materials.

In the general field of medicine, the two branches which have derived the most benefit from these new applications are medical treatment and surgery, and the present discussion is chiefly limited to them.

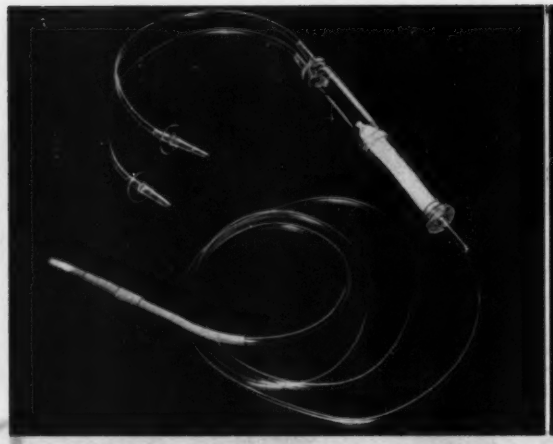
Surgical Repair

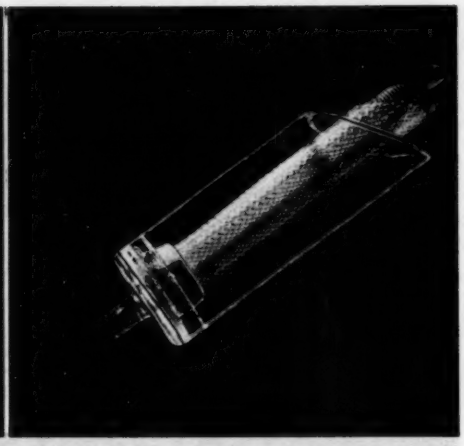
Any substance that comes in contact with human tissue must meet certain general criteria. It must be chemically inert and non-toxic; it must not cause any appreciable harmful reaction in the human tissue; and, in most cases, it must be non-absorbable and not modified by the tissue. (In certain applications, such as sutures, eventual absorption and modification are desirable.) Four plastic materials satisfy these requirements—polyethylene, acrylic, some vinyls, and nylon.

For surgical purposes, pure polyethylene (without a plasticizer) is used in the form of tubing, which will be discussed later, and extruded film. The flexibility of the material makes it ideal to supercede rubber in the replacement of certain body membranes.

One of the most successful implants of polyethylene in the human body is in the replacement of the dura, the tough, fibrous membrane which envelopes the brain. The injured or diseased dura is excised, and pure Du Pont polyethylene film 0.002-in. thick is permanently implanted. The tensile strength and resistance to tearing of this film permit easy, firm suturing.

A thicker form of polyethylene is





Photos courtesy Cutter Laboratories

Infusion equipment—polystyrene barrel, nylon filter, and vinyl tubing —has two tubes for the simultaneous infusion of blood and other solution

Cut-away of polystyrene infusion barrel shows inner plastic core and inner and outer nylon mesh filtering screens

used at the Bowman Gray School of Medicine to cover skull defects. Metal implants were formerly employed. The polyethylene plate, from 0.12 to 0.31 in. thick, depending on the thickness of the bone surrounding the defect, is first cut to the necessary size. Contour is established by immersing the entire plate in boiling water for 30 to 60 sec. and bending to shape by hand. Extremely complicated contours can be matched. Immersing the plate quickly in cold water fixes the contour. The plate is then sutured in place.

During recent experiments on animals at the Mayo Foundation, Rochester, Minn., pure polyethylene bags were placed in the chest cavity to occupy the space left after the removal of one lung. Edges of 0.005-in. thick film were fused together with heat and pressure to form the lung-shaped bag which was packed with fibrous glass to make it hold the desired shape.

Another and more successful plastic lung prosthesis developed at the Mayo Foundation is a sponge derived from formalinized polyvinyl alcohol.[1] The material, supplied by Ivano, Inc., Chicago, Ill., has the same density and consistency as lung tissue. The sponge is simply trimmed to shape and sewn in place. To date, its use has been confined to animals and to a few selected human patients.

[1] See "Vinyl Sponge Replaces Lung," MODERN PLASTICS, 27, 104 (April 1950).

Reactive Film

Most operative procedures using polyethylene require pure film that will not excite tissue reaction. However, reactive polyethylene film has been used at Georgetown University Medical Center in patients suffering from aneurysm of the aorta. The reactive polyethylene encourages fibrous tissue reaction which strengthens the artery wall. In these cases, 1.5-mil film, containing a reactive material, is sterilized and then wrapped around the artery. A layer of pure polyethylene film is placed over the reactive film to protect adjacent structures.

Polyethylene filament is also being used at Georgetown in the repair of hernias. The filament, made by Surprenant Mfg. Co., Boston, Mass., is loosely woven into screens of the desired shape and size and sutured to the abdominal wall, where it has the advantage of not work-hardening as do screens of inert metals conventionally employed.

Internal Acrylic Prosthetics

Certain properties of acrylic make it suitable for use as a replacement for blood vessels and heart valves. These properties include the fact that its smooth surface can be highly polished and is resistant to wetting; hence the material does not promote blood clotting which might result in thrombosis. The Dept. of Surgery at Georgetown University Hospital has utilized acrylic in two interesting applications.

The first prosthesis is the replacement of the aorta by an acrylic tube. In certain diseases, the wall of the aorta a few inches from the heart may become diseased and deteriorate, and the diseased segment must be replaced. Tubes composed of glass, stainless steel, and vitallium have been used in the past, but it was found that acrylic is the only substance that does not induce blood clotting. In addition, it is strong enough to resist body stresses.

In this "intubation" procedure, the diseased segment of the aorta is replaced by the acrylic tube held in position by split nylon rings which are tied in place. Tiny teeth in the nylon rings insure that the acrylic tube cannot become dislodged and that leakage will not occur.

The tubes used for the permanent replacement of aortic segments have been made in diameters ranging from 1 to 2½ cm. and in lengths from 2½ to 20 cm. They are also produced in shapes which can replace the aorta at the point where it arches and where it bifurcates.

The second acrylic application is

an aortic valvular prosthesis to be used when the valve from the aorta to the heart is damaged so that it does not prevent the backward flow of the blood leaving the heart. A tubular ball valve has been developed which is so constructed that the blood can flow through the valve in one direction; when the blood regurgitates, the ball hits the seat in the valve chamber and blocks the backward flow of blood.

To make this prosthesis, a hollow acrylic ball, the specific gravity of which approximates that of blood, is formed and polished. The chamber of the valve and one tapering end are made in a single piece without seams. The seat is formed on the inside chamber wall. After the ball is inserted, the outlet end of the device is formed. Both ends have a tapered leading edge which connects with the amputated ends of the aorta. The nylon rings mentioned above fix the aorta and valve.

The acrylic devices described above were made from stock manufactured by Rohm & Haas Co., Philadelphia, Pa. Fabrication was done by Brunswick Mfg. Co., Roxbury, Mass., which also machined the nylon rings as well as the nylon buttons described below.

Nylon Heart Plugs

A third prosthesis developed at Georgetown is a nylon button-type closure to plug a hole which occasionally occurs in the partition between the two upper chambers of the heart. Two nylon buttons were designed which can be threaded together; their opposing surfaces are covered with small teeth so that when screwed together, they grasp the tissue tightly between them.

To perform the operation, an incision is made in one of the upper heart chambers, and the two buttons, mounted on an actuating instrument, are inserted in the hole between the two chambers. The actuating instrument is turned to engage the two buttons and thus lock the tissue forming the rim of the hole firmly between them. The instrument is then withdrawn, and the incision in the heart is closed.

Further developments of these prostheses are being made through the cooperation of the National Bureau of Standards.

Acrylic in the Hip

A new hip prosthesis for use in treatment of arthritis and some fractures has recently gained recognition. It is a nail of pure acrylic with a bulbous head, which is used as a permanent replacement for the affected femoral head in the hip. To prevent breakage of the stem, a stainless steel insert is embedded in the acrylic before polymerization.

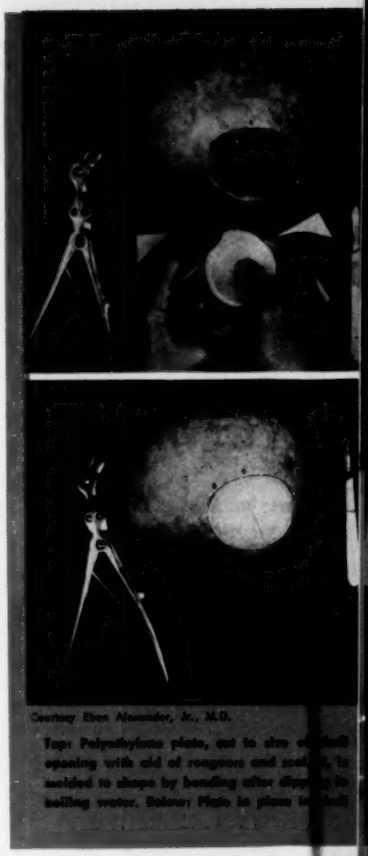
The manufacturer, American Ossacryl Co., New York, N.Y., discarded a number of materials before choosing acrylic, which is perfectly tolerated by the bone structure. The first prosthesis of this kind was inserted five years ago and has shown no changes under X-ray and no tumefaction of the surrounding tissue.

Reports on 300 patients who were treated with this hip prosthesis show that 80% of them were able to work again; 60% were capable of flexion reaching at least a 90° angle; and only 10% were capable of less than 60% flexion at the hip.

For insertion of the prosthesis, the size and depth of the diseased area is studied under X-ray, and a corresponding pin is selected from 12 stock sizes. An incision is made in the hip, the diseased portion of the bone cleaned out, and the prosthesis is fitted into the hip socket in a normal position. The incision is then closed.

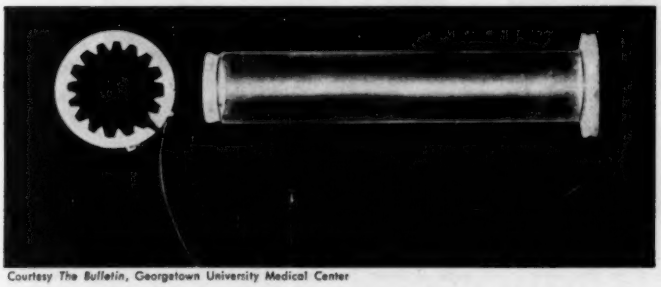
A similar type of hip pin is being used at Robert B. Brigham Hospital, Boston, Mass. The acrylic head is molded in a hollow, hemispherical cup of vitallium under several hundred pounds of pressure. A metal nail, usually 3 to 4 in. long, is molded-in. The length of the nail and the size of the mold cup are determined by the size of the diseased femur.

Another surgical technique developed at this hospital utilizes nylon membrane 0.003 in. thick which is placed between the femur and the knee bone in cases where the two bones tend to grow together and



Courtesy Eben Alexander, Jr., M.D.

Top: Polyethylene plate, cut to size of skull opening with aid of template and soaked to shape by bending after dipping in boiling water. Below: Plate in place in skull



Courtesy *The Bulletin*, Georgetown University Medical Center

Acrylic tube for permanent intubation of aorta (right) is held in place in the body by nylon multiple point fixation ring and suture (left). Ring shown in place at right of tube

Courtesy *The Bulletin*, Georgetown University Medical Center

Right auricle of heart opened to show nylon closure buttons locked in place

thus limit the functioning of the joint. The nylon is fitted to the contour of the knee bone by pleating its edges or by molding over a rounded object.

Sutures and Drapes

Nylon sutures are a surgical application of long standing. The material is odorless, resistant to most chemicals, and withstands repeated autoclaving without reducing its innate toughness and elasticity. It does not deteriorate significantly with age, and is not absorbed by human tissue.

Ethicon Suture Laboratories, New Brunswick, N. J., one of the many producers, supplies nylon sutures in two forms—monofilament and braided multifilament—in 25- and 100-yd. lengths. The monofilament causes slightly less tissue reaction than the braided strands, but is more difficult to tie in knots that will not slip.

Surgical drapes made of vinyl, which are prepackaged and presterilized and are of particular importance for army field hospitals, have already been discussed[2].

Medical and Surgical Tubing

Tubing is the most widely accepted application for plastics in medicine. Tubing for both internal and external use requires a certain degree of flexibility, and vinyl, nylon, and polyethylene all have this property.

For surgical repair of the common bile duct, The Microtone Co., St. Paul, Minn., has molded a polyethylene tube which has been used at the Mayo Foundation. The tube is made in a split cavity mold with a longitudinal removable core pin for forming the central hole. A small air-operated injection press is used. The tube is 3⅛ in. long, with an outside diameter of 0.220 in. and a wall thickness of 0.018 inch. Two reinforcing bands 0.040 in. thick and ¼ in. wide are placed ¾ in. from one end and spaced ⅜ in. apart. A tab 0.040 in. thick projects from the side of the tube at a distance from the other end which is equal to the diameter of the tube. This tab is to be stitched to surrounding tissue. The tube can be cut to appropriate lengths for the surgical procedure in hand.

Another method for producing polyethylene tubes in special shapes has been developed at the Mayo Foundation. These tubes have been used experimentally on animals for the reconstruction of various tubular organs and ducts, such as the common duct, trachea, and colon.

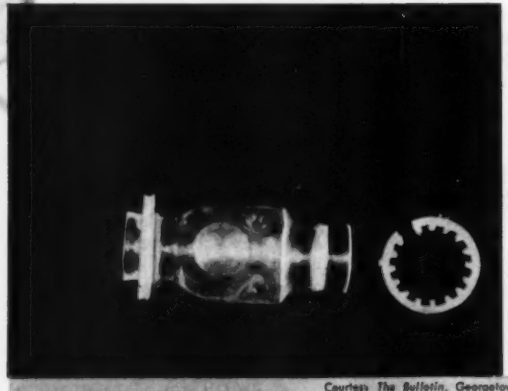
To form one of these tubes, a thin-walled brass tube is selected, the outside diameter of which equals the inside diameter of the polyethylene tube to be made. The brass tube is coated with a film of soap and then with cellophane. Layers of polyethylene film less than 0.02 in. thick are tightly wrapped around the brass tube, and 110° C. heat is applied. The layers of film fuse together under the heat and shrink tightly around the core. There is no longitudinal shrinkage.

If a projecting tab is desired, layers of narrow film are wrapped around the tube at the appropriate point and, during the heat-fusing stage, they are pinched to form the tab. After cooling, the polyethylene tube is easily removed from the brass tube because the soap acts as a lubricant; the cellophane is then stripped from the plastic tube.

Nylon-Phenolic Catheters

For obtaining blood samples from the heart and for measuring blood pressure, United States Catheter & Instrument Corp., Glens Falls, N.Y.,

[2] See "Vinyl Surgical Drapes," MODERN PLASTICS, 28, 61 (May 1951).



Courtesy *The Bulletin*, Georgetown University Medical Center

Acrylic aortic valvular prosthesis and internal ball. Nylon fixation ring (right) is shown in place at left end of the valve

Tapered leading edges of aortic valve connect with severed ends of aorta. Two nylon rings are ligatured at each end

has developed a woven nylon catheter. In making this special tube, strands of nylon, varying in weight from 30 to 800 denier depending on the type of catheter desired, are wound on spools. From 12 to 40 of these spools are placed in two concentric circles on a machine. The two circles rotate in opposite directions, causing the strands from each spool to intertwine and form a braided tube.

After application of a stiffening coat of phenolic resin, the catheters are slipped over wires, mounted in frames or racks, and placed in a spray booth. In the booth, the racks are rotated while the catheters are sprayed with another phenolic-resin solution. Here as many as 15 coats may be applied, depending on the thickness desired. Cure is effected by baking at 250° F. for 1 hour.

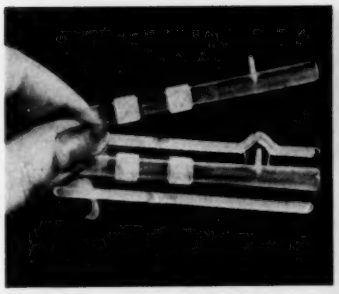
After baking, the catheters are trimmed to length and polished by rotating them against carborundum paper or an abrasive wheel. Sizes range from 0.039 to 0.5 in. in diameter and lengths from 6 to 50 inches.

The company claims that these braided catheters do not buckle when being introduced into the body, yet have the softness and flexibility necessary for their work.

In one use of these phenolic-coated nylon catheters, blood samples are obtained from the heart by a procedure known as intravenous catheterization. A catheter 0.1 in. in diameter and 38 in. long is introduced into a vein in the bend of the elbow and fed through the circulation system into one of the chambers of the heart. By the same technique, it is also possible to obtain samples of blood from the brain, liver, and kidney merely by guiding the catheter into the proper channel. The progress of the catheter is followed by a fluoroscope.

A vinyl tube of small diameter, extruded by Irvington Varnish & Insulator Co., Irvington, N.J., has been used to drain lymph from the liver and thoracic ducts of dogs. Relatively few studies have been made of lymph because of the difficulty in securing samples. The vinyl tube had the necessary flexibility, and did not collapse the delicate ducts nor encourage the lymph to clot as was the case with other materials previously used.

A surgical grade of polethylene tubing extruded by Anchor Plastics



Top: Polyethylene surgical repair tube for bile duct trimmed of gate and runner. Bottom: Tube as taken from mold

Co., New York, N.Y., is used in intravenous applications and for catheters. In one pneumothorax process, this tubing was used to collapse the lung and was left for 30 days with no discomfort to the patient.

Other internal medical uses of vinyl and polyethylene tubing include drainage of the brain, urethral catheterization, and the probing and treatment of most internal organs.

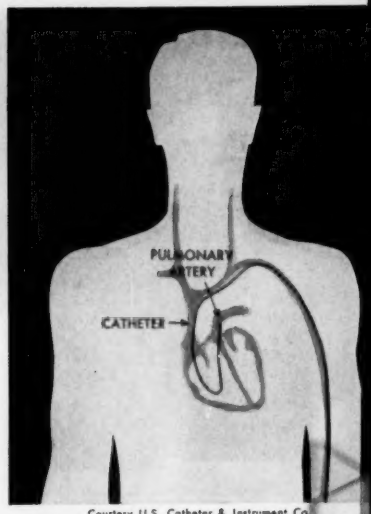
In Blood Infusions

In the administering of blood infusions and in intravenous feedings, vinyl tubing has largely replaced rubber. Here the tubing does not come in direct contact with the patient—at one end it is attached to the receptacle containing the liquid and at the other end it joins the infusion needle. Tubing of this type is being supplied by a number of companies, including The National Varnished Products Corp., Woodbridge, N.J.; Resin Industries, Santa Barbara, Calif.; The United States Stoneware Co., Akron, Ohio; Surprenant Mfg. Co.; and Irvington Varnish & Insulator Co.

Recently, however, it has been found that the steel infusion needle can be replaced by a small plastic tube. In infusions of long duration this has two advantages. The plastic tube will rarely puncture the wall of the vein as does the steel needle, and its flexibility allows greater comfort for the patient.

One technique for the insertion of the plastic tube has been developed at the Mayo Foundation. A 3-in. length of vinyl tubing supplied by Irvington Varnish is soaked in acetone and rinsed in water. This enlarges the tube and makes it limp. It is then slipped over a steel needle and the unit is autoclaved. The steel needle, sheathed with the vinyl tubing, is introduced in the vein in the normal manner, and when the tip has advanced far enough, the steel needle is withdrawn, leaving approximately 2 in. of the plastic tubing in the vein. The free end is attached to the tube of the infusion container, and the blood or intravenous solution is administered.

A similar technique has been de-

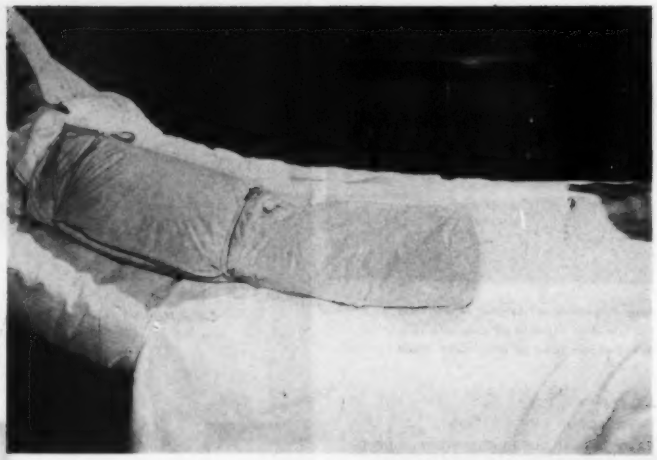


Courtesy U.S. Catheter & Instrument Co.

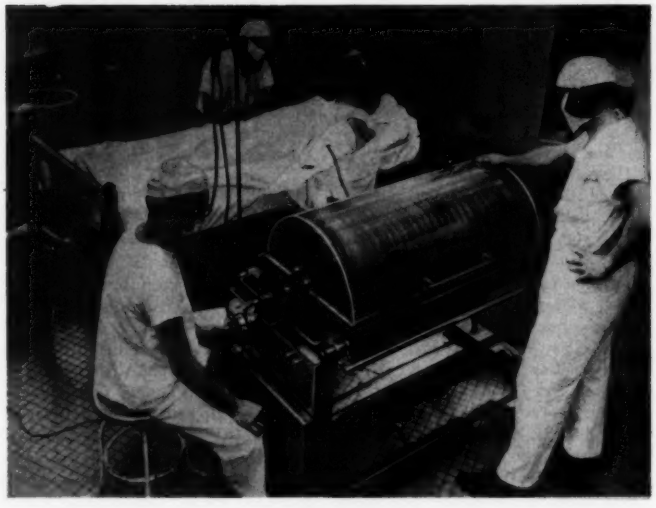
Nylon-phenolic catheter is fed into the heart to obtain a sample of blood

Courtesy Anchor Plastics Co., Inc.

Polyethylene tubing shown (l. to r.) on spool; attached to syringe; and in four sizes with indicated diameters



Courtesy Owens-Corning Fiberglas Corp.
Insulating sleeve has inner layer of vinyl film and outer sandwich of two layers of opaque vinyl sheeting between which is 1 in. thickness of glass fiber insulation. Sleeve prevents loss of heat from the skin of the patient



Artificial kidney is housed in semi-cylinder made of acrylic chosen for its biological inertness and good visibility. Blood tapped from patient's arm is routed through cylinder where the toxic accumulations are removed

Courtesy Allis-Chalmers Mfg. Co.

vised using polyethylene. The tubing, also furnished by Irvington Varnish, has an internal diameter of 0.025 in. and a wall thickness of 0.004 in. It is inserted through a large bore steel needle, which is introduced into the vein.

In addition to polyethylene and vinyl tubing used in infusion sets, the barrels of such equipment are also being made in plastic. As sterile as glass, the plastic infusion sets are disposable after one use, which makes them extremely valuable for army field hospital use.

The barrel of one infusion set, assembled and marketed by Cutter Laboratories, Berkeley, Calif., is injection molded of Koppers polystyrene by Modern Plastic Co., Los Angeles, Calif. The barrel is a long cylinder, one end of which is capped by a closure with a projecting pin which is inserted into the vinyl infusion tubing and needle. A cap and projecting pin at the other end is attached to the infusion container and tube. If two solutions are to be administered at the same time, this second cap has two projections, each leading to a separate infusion container. A nylon monofilament filter in the barrel strains gross matter from the blood or infusion liquid.

Vinyl transfusion equipment, including a blood collection bag and infusion set, have been described.[3]

Many infusion sets have a nylon needle adaptor which joins the infusion tube and the infusion needle. Two firms molding adaptors are Atlantic Plastics, Inc., Stamford, Conn., and Sunlight Mfg. Co., Chicago.

[3] See "Vinyl Blood Pack," MODERN PLASTICS, 29, 92 (Sept. 1951).

Hospital Equipment

In addition to the plastics materials described above, which meet the general criteria required for their use in contact with human tissue, numerous other plastics have been utilized in auxiliary medical equipment for external use.

One such application is an insulating sleeve recently developed at Peter Bent Brigham Hospital, Boston, Mass., which is used to replace conventional hot pack poultices. Known as Autotherm, the sleeve consists of an inner layer of vinyl film which acts as a water vapor barrier. This maintains the moisture content of the body and prevents heat loss by evaporation. Over this is an outer sleeve consisting of two layers of opaque vinyl sheeting between which is a 1-in. thickness of Fiberglas insulation. The insulation prevents heat loss from the skin by radiation, and there is no need to apply extra heat. The vinyl film and sheeting are supplied by Plymouth Rubber Co., Inc., Canton, Mass.

Two respirators take advantage of the light weight of Plexiglas for their shells. One model is made by Fairchild Camera & Instrument Corp., Jamaica, N.Y., and uses ⅛-in. thick acrylic for the shell which is

formed to body contours by Scheidl Mfg. Co., Copiague, N.Y. The other respirator, a portable type, is made by J. J. Monaghan Co., Denver, Col.

Artificial Organs

A Plexiglas semi-cylinder is used to cover an artificial kidney made by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The acrylic, which is formed by Midland Plastics, Inc., Milwaukee, Wis., was chosen for its biological inertness and good visibility. Blood is routed from the patient's arm to the artificial kidney where toxic accumulations are removed. The blood is then returned to a vein in the patient's leg.

Plexiglas is also used as a housing for a heart-lung machine.[4]

Complete transparency is afforded by a Plexiglas hood on an incubator so that premature babies can be observed at all times. Called the Isolette, the incubator has a hood of formed acrylic ¼-in. thick. Four portholes covered with vinyl film allow the baby to be given necessary care without disturbing the carefully controlled atmospheric conditions inside the incubator. The unit is manufactured by Air-Shields, Inc., Hatboro, Pa., which also makes a humidity and oxygen tent with a canopy of 0.004-in. cast vinyl film.

An oxygen air pressure lock manufactured by Loewenstern Corp., Houston, Tex., is housed in a Plexiglas cylinder which has a high insulating value. A constant temperature of 100° F. can be maintained. The cylinder is formed by Southwestern Plastics, Houston.

A great many plastics applications too numerous to more than mention here are finding increasing use in hospitals. Some of these include phenolic and acrylic prostheses for limbs, vinyl sheeting, acrylic bassinets and other maternity ward equipment, and a portable flushing toilet with a Royalite seat.

Various plastics resins have also been taken internally by patients, such as ion exchange resins to relieve the discomfort of dropsy and vinyl compounds as plasma substitutes, but they have not been treated in this article because medical results are still inconclusive. Related fields of medicine, such as ophthalmology and dentistry, have been omitted entirely due to space limitations.

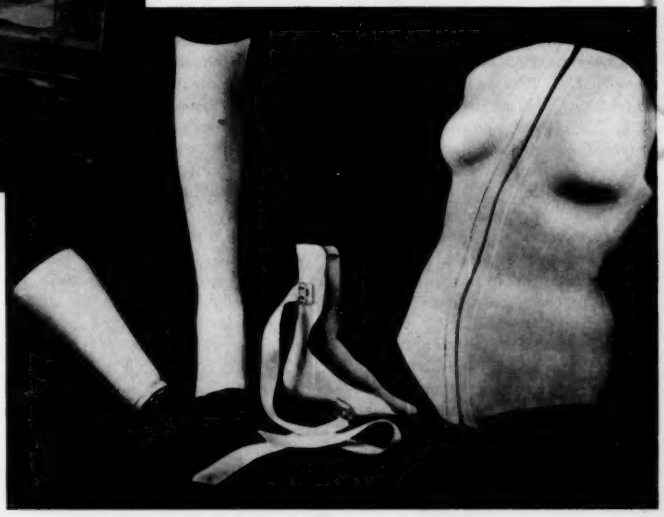
Acknowledgements

The following surgeons have been of great assistance in gathering material for this article. Eben Alexander, Jr., M.D., Bowman Gray School of Medicine, Winston-Salem, N.C.; M. Hunter Brown, M.D., Los Angeles, Calif.; John H. Grindlay, M.D., Mayo Foundation, Rochester, Minn.; J. B. Hickam, M.D., School of Medicine of Duke University, Durham, N.C.; Charles A. Hufnagel, M.D., Georgetown University Medical Center, Washington, D.C.; John G. Kuhns, M.D., Robert B. Brigham Hospital, Boston, Mass.; Donald D. Matson, M.D., Peter Bent Brigham Hospital, Boston, Mass.

[4] See "Plastics in a Mechanical Heart," MODERN PLASTICS, *28*, 166 (April 1951).

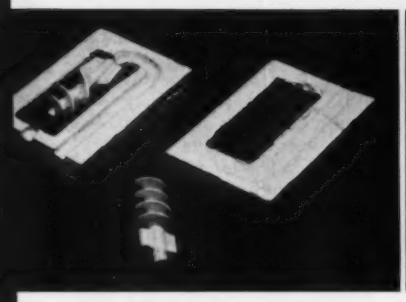
Courtesy Rohm & Haas Co.

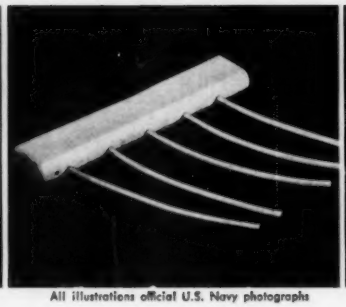
Hood of incubator is ¼-in. acrylic, affording complete transparency and maintaining constant interior temperature. Four portholes, covered with vinyl film, allow baby to be tended without disturbing atmospheric conditions

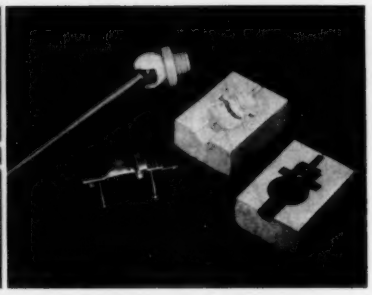


Courtesy Bakelite Co.

Phenolic laminating resins are used for braces and prosthetic devices. Sheets of glass fiber cloth are saturated with resin, then built up in layers over a plaster cast. After cure, hardened laminate is removed from cast and finished







All illustrations official U.S. Navy photographs

1 Double pitch helix is made of epoxy chosen for strength, good flow, and low shrinkage

2 Voltage divider with large imbedded insert needs low-shrink casting material

3 Epoxy mold (right) for casting epoxy housing for antenna lead-through (left)

Casting Expoxies at the NRL

DURING its many years of activity, the Plastics Section of the Naval Research Laboratory of the Office of Naval Research has not only operated a research and advisory service available to all Navy personnel, but has also produced prototype models of plastic components required for weapons and specialized uses. Injection and compression molding facilities are maintained, extrusion equipment is available, and a great many parts have recently been cast to shape.

These cast components have been made from a new series of epoxy or ethoxyline materials which have been used with consistent success. They are known as Coil Seal 11 and Coil Seal 17, produced by National Engineering Products, Inc., Washington, D.C. The materials possess the following basic properties:

1) They are pourable liquids which flow into small apertures and penetrate porous areas such as a fibrous insulation.

2) Parts may be cast at atmospheric pressure and with no baking, reactivity being attained through the addition of a hardening resin which is completely reactive with the casting compound.

3) The heat of reaction is sufficiently limited to permit casting small parts in molds made of plastisol, rubber, methyl methacrylate, or plaster of paris.

4) The shrinkage during curing ranges from 0.5 to 2.5% by volume, which permits the use of large imbedded inserts without structural strains causing ultimate cracking or electrical break down.

5) These materials are unusually resistant to dielectric stresses which permits their successful use in components where other dielectrics have failed.

6) The curing of these materials is not inhibited by air, and they are not affected by copper or other metals or any other plastic material.

7) Since these materials are highly mobile and have an extended "pot-life" prior to solidification, it is practical to form them by "injection casting."

Casting Applications

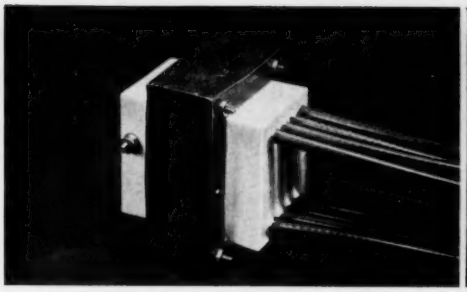
These natural advantages are vividly demonstrated by the accompanying photos of parts which have been made from these materials and used in actual service conditions.

The part shown in Fig. 1 is a double pitch helix which must be cast in a flexible mold because of the under-cuts in its contour. The mold is made of a plastisol and the part is cast of Coil Seal 11, chosen because of its superior strength, its ability to flow readily into small sections, and its low shrinkage which helps to hold close tolerances.

The part shown in Fig. 2 is a voltage divider which contains a very large imbedded insert, therefore necessitating the use of a material having minimum shrinkage and high resistance to arcing. Coil Seal 17 was chosen for this job because, in addition to low shrinkage, it cures at room temperature and thus eliminates danger of strains which are especially prevalent in this type of job due to length of the rigid resistors. Room temperature curing also helps to avoid shrinkage from lead wires. Casting is done in a plastisol mold.

The antenna and accompanying hardware in Fig. 3 are used to reduce or eliminate as much as possible the static which is produced in airborne communications equipment by precipitation. The hardware is exposed to weather and must be designed to have minimum effect on the speed of an airplane. This rig is shown at the left. The polyethylene wire support and joint, together with the polyethylene nut, are placed in a Coil Seal 17 mold with a vinyl parting coat, and Coil Seal 11 poured around them. A small section of imbedded glass mat is used for reinforcement. Cure time is 4 hr. or less at room temperature. The plastic material forms the housing for the joint and the lead-through—note how well it takes the threads. This adjustable antenna lead-through adapter provides for an adjustment of 90° in elevation and 360° in train-horizontal direction. Before this rig was designed, a fixed adapter with an acrylic and phenolic housing was used. The ball joint arrangement was devised so the lead-in could come from any direction.

Another antenna wire support not illustrated here consists of a plasti-



4 Polyethylene-coated secondaries of small transformer are potted with ethoxyline resin cast in acrylic mold

5 Housing for circuit of airborne antenna is made of laminate of fibrous glass tape and epoxy. Circuit is potted with another type of ethoxyline

sol-impregnated cord or tape which is wrapped on a mandrel to obtain the desired shape. The combination gives the resilience of the plastisol and the strength of cord to the wire support, and, it is thought, will eliminate the cold flow problem encountered with polyethylene.

Figure 4 shows a small transformer which is used in an electronic circuit having a potential gradient of 80 kv. to ground, in which the secondaries are potted with Coil Seal 17 cast in a Plexiglas mold. Poly-dichlor-styrene is the only other insulating compound which has been used successfully in the construction of this part.

This transformer has four polyethylene-coated secondary windings in which adjacent windings must withstand 20 kv.; the final winding is subjected to 80 kv. insulation strain with respect to ground potential. It was necessary to pot the secondary turns with a resin that would: 1)have good dielectric properties; 2) cure at room temperature with low exothermic heat build-up (the polyethylene wires were bent into U-shape and a rise in temperature would cause the conductor to "walk" off-center at the bends); 3) bond to itself (spacers of the same material were used to hold the secondaries in place); and 4) have low shrinkage (so that it would not shrink away from the polyethylene wires leaving voids and increasing the probability of corona).

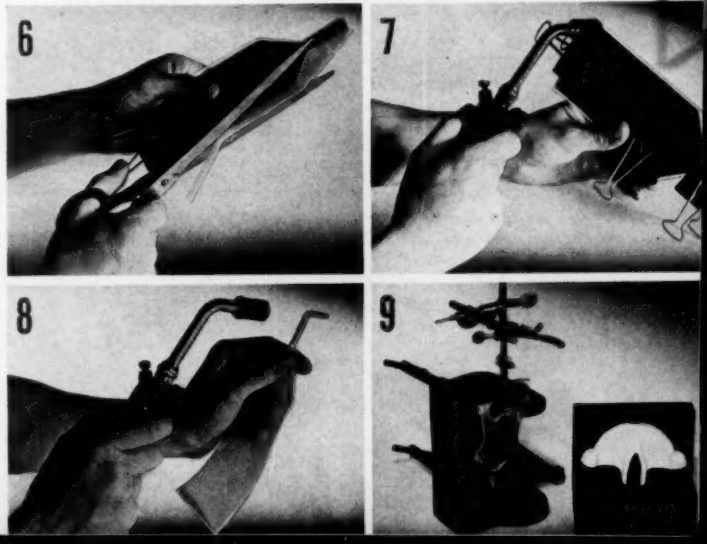
Figure 5 is a special housing for an airborne antenna to enclose and protect a fragile electronic circuit. The housing is laminated of fibrous glass tape and Coil Seal 11, cast to the outside shape in a plaster of paris mold. The electronic circuit within the housing is potted with Coil Seal 17 in order to reduce radio-frequency losses.

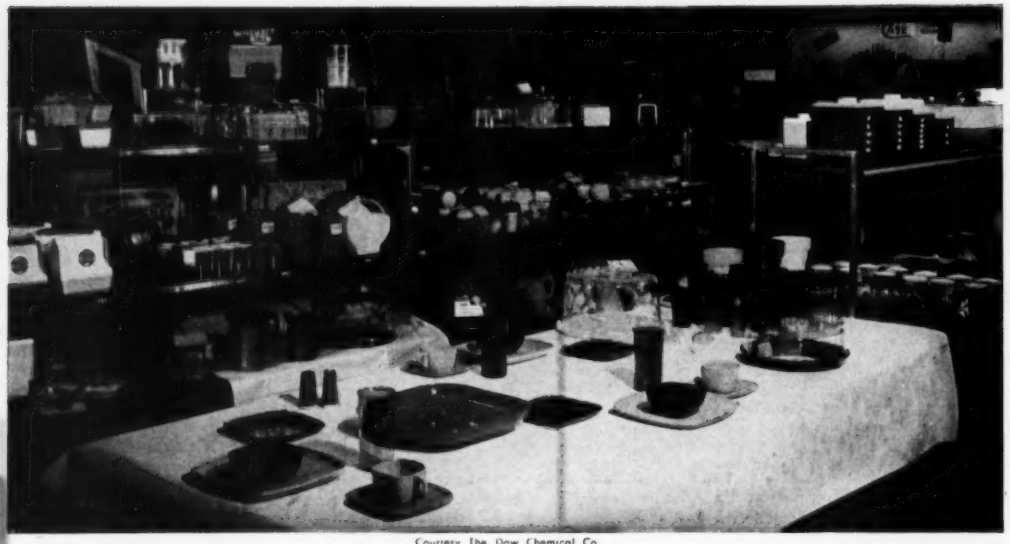
Casting Procedure

Figures 6 to 9 illustrate the use of polyethylene film in the "injection casting" of these epoxy materials. Since this film is quite inexpensive and readily formed to shape by flame sealing, it is fully practical to use this process as a means of injecting these materials into complex apertures or in very small sections around complicated inserts.

The "injector" for this process is simply a polyethylene bag with a glass tube spout. The bag is made by clamping two sheets of polyethylene, from 5 to 8 mils thick, in a metal form and cutting to shape. The edges are sealed by a gas torch, and the small end is sealed around a glass tube simply by using the torch to warm up the polyethylene and shrink it around the tube. The epoxy is then poured in the bag and squeezed out from the bottom into the mold aperture. A great advantage is that the mold may be filled from the bottom at room temperature. Infra-red rays can be used if there is a desire to speed up the process. This method of injection was used to squeeze epoxy between all the inserts in an 18-in. long bus bar.

Use of polyethylene bag in "injection casting" of epoxy materials. Fig. 6—Two strips of polyethylene clamped between metal plates are being cut to shape. Fig. 7—Flame sealing edges of the strips. Fig. 8—Polyethylene film is shrunk around the glass tube by heat. Fig. 9—Completed "injector" set up to fill mold from bottom. At right in photo is mold of type used in this work





Courtesy The Dow Chemical Co.

Plastics housewares molded of dry-colored polystyrene meet the demand for bright-colored, low-cost products and lend themselves to effective displays. Properly used, dry coloring is becoming an influential factor in the marketing of molded polystyrene products

Dry Coloring Proves Its Case

by RUSSELL F. DUNCAN

FIRST doubtful hope, then enthusiastic acceptance, then experimentation to broaden the field of application—that is the history of the attitude of plastics molders toward dry coloring.

It all started with styrene. And in the progress made to date are combined the factors of machine design, mold engineering, product styling, and cost economics.[1] So fatefully, if apparently accidentally, were these factors coordinated in the advances of dry coloring to date that one is almost inclined to say, "Kismet!" Dry coloring of thermoplastics had to be. And now it has to be bigger, more generally useful as applied to a wider variety of resins, more foolproof in more uses.

It started with styrene, but today improved dry coloring techniques are solving problems in plastisols, organosols, polyesters, acetate, butyrate, polyethylene, etc.

Many molders have wondered why these advanced coloring techniques were not worked out years earlier. The reason was that, prior to World War II, thermoplastics were still in their infancy and the industry had more important problems of workability to solve. During the war only olive drab plus three or four other colors were needed and the development of these, along with manpower and production problems, took up all the molders' time.

Anything Went

Immediately after the war, there was a big rush to get back into civilian production. The new thermoplastics were vastly more available for consumer goods. Retail shelves were bare and needed filling. The public would spend its money on literally anything made in any color. The same thing happened in color of plastics products that happened in product design for plastics and in engineering for these new materials: anything could get by and cost was not a major factor.

But late in 1946 and through the first half of 1947 proprietary injection molding, like several other industries, suffered a genuine recession. Products were not good enough, they cost too much, and there was neither the variety of color nor the sophistication in color usage the market demanded.

What had happened in taste at consumer level was what happens after every war. The housewife,

[1] See "Latest Advances in Dry Coloring," by Sanford Glick, MODERN PLASTICS *28*, 79 (Feb. 1951).

RUSSELL F. DUNCAN

Russell F. Duncan, manager of the Color Div., Ferro Corp., has been with Ferro since the start of its Color Div. in 1939. His previous experience in color was with Harshaw Chemical Co. and Mullins Mfg. Co.

having been satisfied with dull colors in limited range during the emergency, had a natural desire to give vent to her emotions engendered by freedom from fear by buying new paint, new drapes, new carpet, and new household equipment in bright and clean colors. The opportunity for promotion of plastics by virtue of their color was immense.

That is where cost economics came into the picture, particularly in the case of styrene products which were already making great headway in housewares and toys. The price of factory-colored styrene was considerably higher (average about 5½¢ per lb.) than crystal material, yet molders had to have colored material in order to sell their merchandise. They could afford only to keep a very small inventory of any color, or to restrict stock to a very limited range of color in their plastics merchandise.

So, when the public's first postwar spending spree was over and the recession came to thermoplastics, when the housewife demanded better and more colorful plastics products at lower prices, the simple cost economics of colored molding materials became a serious problem to every molder.

Millions of Shades

The normal human eye can distinguish 10 million distinct shades and tones of color. It has been estimated that there are nearly ¼ million plastic colors, including metallics, phosphorescents, fluorescents, opaques, translucents, transparents and pearlescents. One material maker alone has 70 thousand cataloged colors of polystyrene. The problem facing a molder who wished to take full advantage of his opportunities in color, yet who wanted to cut his costs, was obvious. The styrene wall tile molders, for example, had a bonanza market if the problem could be overcome.

Since the problems were greatest and the opportunities were greatest in styrene, it is natural that that material received first attention. Something more flexible and less costly than machine compounding had to be developed. Yet the crystal of styrene plastic was of such a nature that no color material could be placed inside of it; the crystal was merely coated with color. So the first thing done was to cut the size of the styrene crystal—in half, then in quarter, then even smaller. This development fell short of expectations until the further development of surface lubrication of styrene plastic crystals in 1946. Surface lubrication was not developed for coloring but for speed of molding, ease and uniformity of flow in the mold, and for facility of pin-point gating, which in turn permitted high pressures and high heats to be used in the molding of larger area pieces. It was found in dozens of plants that pin-point gating, coupled with a new type of mold design permitting controlled flow of material through the mold, coupled again with smaller particle size in styrene, permitted better and faster molding with the possibility of tossing the degated scrap right back into injection machine hoppers, which of course produced greater economies. It was further found that this lubricated small-particle styrene could be tumble colored with a variety of dyes and pigments in batches of any size from a few pounds to a ton at a fraction of the cost differential between crystal and color-compounded materials.

Problems Solved

Naturally, many mistakes were made. Early efforts were limited to a very few strong colors such as reds and yellows. Whites were and still are a problem. Blues were a problem but are no longer. Early moldings from dry colored styrene might be streaked, marbleized, or otherwise unacceptable. As more and more molders took up the technique and enjoyed its economies, as material makers and color specialists worked on the problems, the whole process became so perfected that today by conservative estimate, more than 60% of all styrene molded is dry colored.

There are two types of colors used in dry coloring of plastics. These types, organic and inorganic, may be used separately or together. Inorganic colors are often called pigments while organic colors are called dyes. This is generally true but there are some exceptions. An organic color may have as its base

(*Continued on p. 198*)

Bottles molded of dry-colored polyethylene have good eye and sales appeal. Careful color selection and blending are needed to produce attractive, high-quality merchandise

Courtesy Injection Molding Co.

Shrouds for Machine Tools

Photos courtesy Monsanto Chemical Co.

Large envelope type vinyl shrouds are made in 50 sizes to protect widely varied sizes and shapes of heavy production equipment during shipment and while stored out-of-doors

Vinyl shroud is secured to skid by rope passed through grommets. Bag of corrosion inhibitor is used as cushion over machine protuberances that might otherwise puncture shroud

by KENNETH E. JOY*

ONE of the latest developments in the use of plastics by the Army Ordnance Corps is the application of large envelope type shrouds of vinyl plastic to protect shipments of heavy production machinery. A considerable saving in the expenditure of taxpayers' money is expected as a result of this use of plastic, since heavy canvas tarpaulins, wooden boxes, and crates are several times more expensive.

Large shipments of big gun-boring lathes, millers, grinders, and various special types of machines now being removed from war reserve storage to meet armament production requirements are being protected with these shrouds. Their development, initiated by Army Ordnance, is a reflection of the increased usage of plastics in our National Defense program.

Need for protection of equipment, both during shipment to industry users and during the periods of siding and out-of-doors storage that are necessary under large-scale reactivation activities, has pointed up the desirability of having a rapidly applied, effective, and economical method of this type.

Vinyl Does the Job

The vinyl plastic material used in the initial phases of the project was obtained from Monsanto Chemical Co., which contributed both in establishing the physical characteristics of the plastic and in furnishing a material that would do the job.

Good tensile strength, availability, and low cost were already existent in the vinyl film commonly used in commercial products such as raincoats and shower curtains. It was essential, however, to so stabilize this material that it would retain its original properties under outdoor exposure and service conditions and not become brittle and crack or shatter in sub-zero temperatures. It was also necessary that this material withstand constant wind-whipping on open flat car shipments and temporary out-of-doors storage. Wind

*Ordnance Engineer, U. S. Army Ordnance Corps.

velocities as high as 60 miles per hour and extremes of temperatures ranging from sub-zero up to and in excess of 95° F. indicate the ruggedness that is required. An 8-gage film is now doing this job.

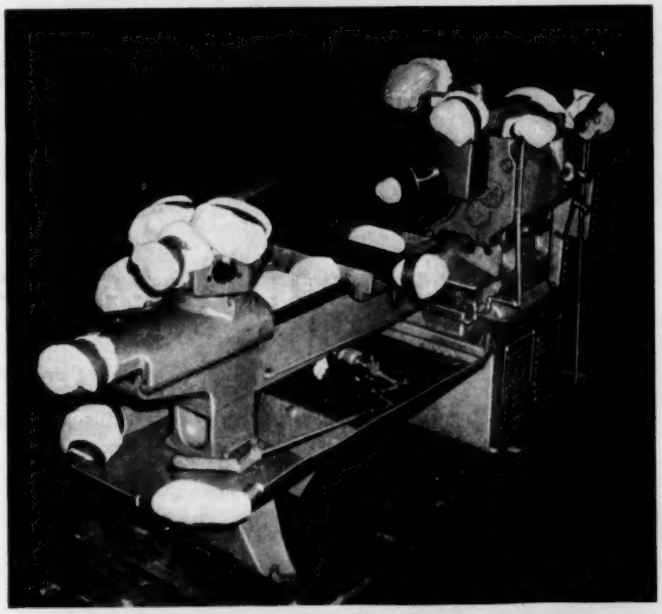
A standarization of approximately 50 different sizes of shrouds has been accomplished to provide a general conforming envelope type to fit the great variety of sizes and shapes of machines that are involved. The National Transparent Plastics Co., Springfield, Mass., has contributed largely to this standardization of sizes and to the methods of fabrication of the shrouds. Carefully controlled electronic weldments, reinforcements at critical points of heavy strain, and properly located tie-down grommets represent some major fabrication requirements.

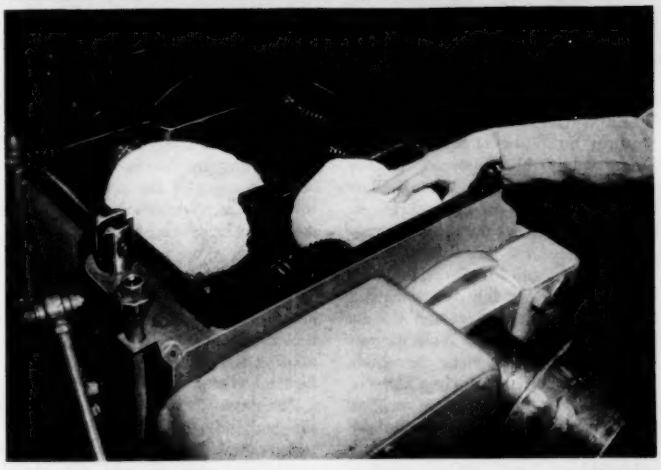
For the purpose of comparison, a vinyl envelope type shroud of ample proportions to provide full coverage for a machine weighing 20,000 lb. weighs approximately 30 pounds. A waterproof tarpaulin of the type normally used will weigh several times this amount and is several times more costly, particularly if it is preformed to provide full coverage of the machine.

Corrosion Inhibitor

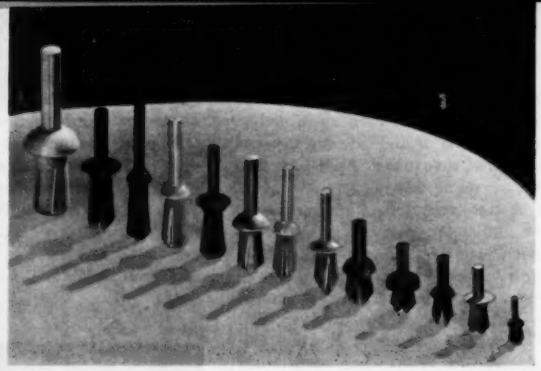
An additional and very significant feature of this method of protection has been achieved through the use of a volatile type corrosion inhibitor developed by the Shell Oil Co. under the trade identification V.P.I. (vapor phase inhibitor). This material builds up a free and continuously recurring atmosphere under the shroud that prevents rusting of precision surfaces even though moisture settles under the shroud. The application of this additional protective agent was contributed to largely by the Marvellum Co., Holyoke, Mass. The inhibitor material is applied to a heavy kraft paper which is used both in shredded (similar to excelsior) and sheet form. The shredded material is packed into cheese-cloth or similar loose fabricated batts or bags. These are tucked into gear boxes, laid along machine ways, or tucked around spindles. Thus they build up the corrosion preventive atmosphere around the critical parts of the machine which have previously been treated with a petroleum base preservative compound. These same batts are used to form protective cushions over sharp protuberances on the machine that would otherwise puncture the shroud. This padding is very important and is a must in the successful application of this method of protection. The machine is then draped with heavy kraft paper that has been treated with the corrosion inhibitor; the shroud is applied and secured to the skid by a rope passed through grommets.

This method of protecting machinery, like other proved methods, will fail if the essential characteristics of its application are in any way minimized. It will and does do an excellent job if properly applied, and it is very significant that cost and labor of application are low.





Top: Bags of shredded vapor phase inhibitor are laid along machine ways, tucked in spindles, or tied to outer surfaces to build up recurring corrosion-preventing atmosphere under shroud. Bottom: Bags tucked into gear box offer added protection to critical parts



Plastic rivets, made in a wide variety of sizes, colors, materials, can be applied with simple tools and with access to only one side of hole

Name plate being fastened to a switch box with plastic rivets. Bus bars under panel cannot be short-circuited by non-conductive rivets

Rivets That Need No Bucking

Latest developments of plastic rivet principle include combinations of fastener with shelf supports and knobs

CONTINUED development of the plastic rivet (MODERN PLASTICS, June 1944, p. 92) now finds this ingenious fastener in commercial production and enjoying steadily increased usage by manufacturers of refrigerators, electronic equipment, and other products where its unique properties can be used to advantage.

This versatile plastic item, which made its first appearance during World War II, is so designed that it requires no "bucking up" from the other side when driven. Trademarked Plasti-Rivet, the product has undergone extensive refinement and improvement by Shakeproof Inc., Div. of Illinois Tool Works, Chicago, Ill. This company is now producing the device in the form of a standard rivet and also in various modifications, such as refrigerator shelf supports, in which the same fastening principle is used.

Plasti-Rivets are injection molded in one piece, using nylon, cellulose acetate butyrate, ethyl cellulose, polyethylene, and other suitable thermoplastic materials. They may be used to fasten together two or more sheets of plastic, paper, metal, or other material or to anchor a name plate, shelf support, clamp, or other object to another surface.

Permanent Fastening

Achievement of a permanent fastening without the necessity of bucking the rivet is made possible by the fact that the rivet is automatically expanded from within when driven. The one-piece rivet is comprised of a hollow body and solid pin, with the shank of the body terminating in flaring prongs. The outward taper of the prongs causes them to move toward each other when inserted in an installation hole. The prongs are then forced apart when the pin is driven through, providing a positive locking action which tends to draw the fastened members tightly together, holding them firmly against the effects of vibration.

The device is designed so that the pin and the rivet body are molded integrally with a thin collar of plastic joining the pin and the rivet head. The force normally required to shear the pin from the head is greater than that necessary to seat the rivet in the installation hole. Accordingly, an impact blow on the end of the pin simultaneously seats the rivet, fractures the pin, and drives the pin through the body, so that the wedging action takes place at the shank. Anyone who can drive a nail can install Plasti-Rivets.

The plastic rivets have a number of structural, decorative, and electrical insulating features which make them ideally suited for many fastening applications. They offer obvious time and money saving opportunities in the assembly of radio and television sets, electrical appliances, automotive component parts, and other products. They can be used effectively with plastics, metals, glass, wood, fiber, leather, textiles, paper and paperboard, as well as such materials as plaster, concrete, and wallboard. One of the greatest virtues of the plastic fasteners is the fact that they do not damage the materials assembled.

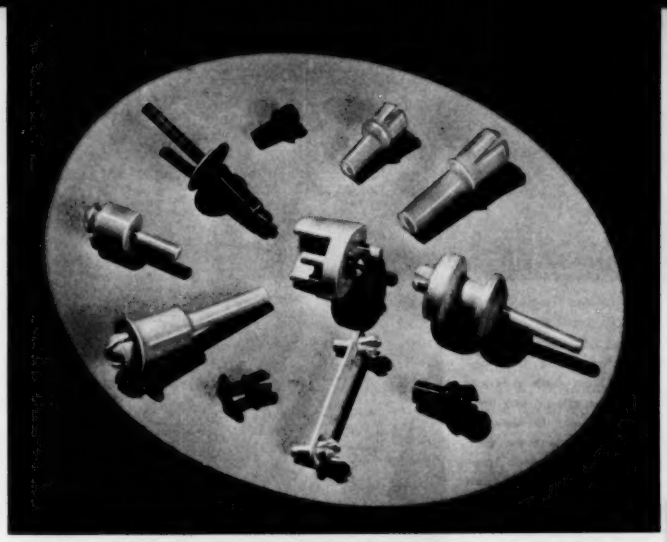
Test Data

The size of rivet and type of material best suited to a particular application depend upon service condi-

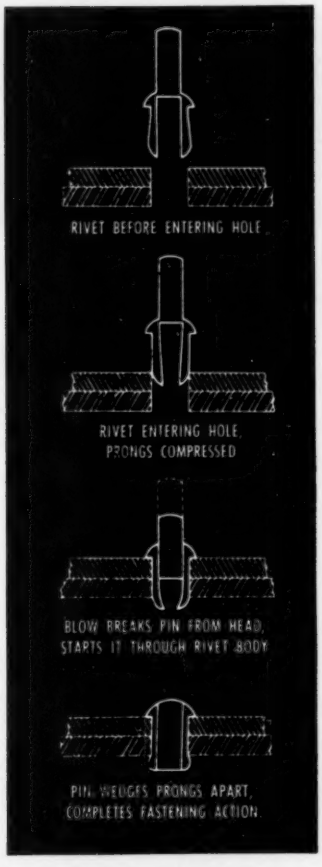
tions. The table found on p. 102, based on tests run on Plasti-Rivets molded of Du Pont FM-10001 nylon, gives comparative figures on ultimate tension, single and double shear, recommended maximum load, and related data.

In modified form, the rivets are available as Plasti-Grommets, a combination rivet fastening and grommet which permits an insulated wire to be passed through the fastened members, providing further insulation and protecting it against abrasion. Here the pin itself, as well as the rivet body, is hollow. In addition to supplying standard lines, the manufacturer can also incorporate the patented fastening principles of the rivet in special designs.

Plasti-Rivets of special design



Basic principle of the plastic rivet is applied in the design of these special units, each of which is a combination of a fastener and a lug, handle, or other fitting

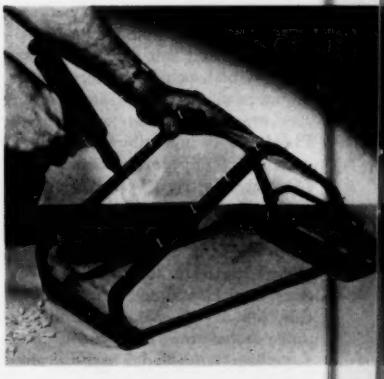

RIVET BEFORE ENTERING HOLE
RIVET ENTERING HOLE, PRONGS COMPRESSED
BLOW BREAKS PIN FROM HEAD, STARTS IT THROUGH RIVET BODY
PIN WEDGES PRONGS APART, COMPLETES FASTENING ACTION

Section drawings show how pin driven through body of rivet spreads prongs

have successfully solved an assembly problem which has long challenged cabinet engineers in the refrigeration industry—that of securing shelf supports to the inner walls of home refrigerators. Several leading producers, including Westinghouse, Crosley, Admiral, Deep Freeze, Kelvinator, and Seeger (Montgomery Ward) are now using refrigerator shelf supports incorporating the Plasti-Rivet principle. Exhaustive tests by both Shakeproof and the individual manufacturers on cold flow, resistance to vibration, impact resistance, and other factors have proved the suitability of the plastic rivets for this application. Dow #475 modified polystyrene has been used exclusively for these supports and acceptance by manufacturers has been very satisfactory.

Cost Savings

In addition to offering definite cost savings on installation and part price, the plastic supports have eliminated crazing around porcelainized holes, often encountered when using metal supports and metal type fasteners. Prior to the Plasti-Rivet, manufacturers had secured shelf supports to the inside of refrigerator cabinets by means of washers and screws, welding, fasteners which required clinching, or other cumbersome and expensive means. The plastic rivet, easily applied from the inner side of the cabi-



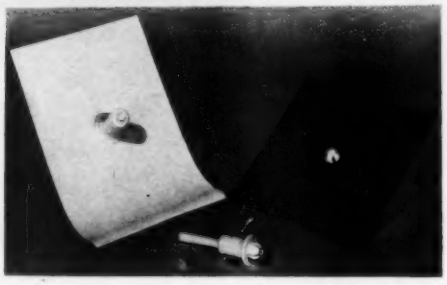
Spring-operated hammer quickly sets new rivets to hold shield to frame

net, has proved ideal for this use.

Manufacturers of electrical equipment have been quick to take advantage of the insulating properties of Plasti-Rivets. Western Electric Co., Chicago Switchboard Co., Inc., and The Square D Co. have replaced metal fastenings with the plastic rivets in applications where arcing burned metal fastenings.

RCA and Du Mont are conducting tests on similar uses in radio and television assemblies. At Du Mont, a 30-in. television tube was supported by a wooden framework, with a formed sheet of plastic material separating the tube from the frame. The plastic sheet was secured to the

Plastic rivet made in the form of a drawer pull. In this case the main body of the rivet is molded in the shape of the pull or knob



How the plastic rivet appears from both sides of the sheet after it has been driven home. In view at right can be seen the open rivet prongs which provide the locking action

wooden support by means of metal fasteners, which burned out completely the first time the set was turned on. The non-metallic Plasti-Rivets worked satisfactorily in this application because they created no arcing problem. Many DO rated jobs are reported to be using nylon Plasti-Rivets in similar applications.

At its Bridgeport, Conn., plant, General Electric Co. employs the plastic rivets to attach an aluminum bottle cover to the underside of a flat top ironer. A jar is subsequently screwed into the top to collect condensation. Plastic rivets are used on this job because the assembly is made after the component parts have been enameled. The head must match the enamel in color; the rivet must not chip the enameled surface.

Seating rivets in a deep-freeze cabinet using an ordinary soft-nose hammer

Telechron, Inc., Ashland, Mass., uses Plasti-Rivets to secure a plastic clock frame to a base fabricated of metal tubing. The application requires a blind rivet which cannot craze the plastic component. In an application by another manufacturer, the rivets hold metal hinges on plastic bread boxes.

Colors Matched

A leading manufacturer of station wagons is considering the use of Plasti-Rivets in applying phenolic laminates to the interior of the body. Plasti-Rivets are especially effective in this application because they can be made to match the color of the wood grain door panels and rear deck facing which they fasten.

Kroehler Mfg. Co. has successfully tested the plastic rivets in fabricating one type of theater seat which includes a metal pan or support fastened to the plywood bottom of the seat. Wood screws, used previously for this purpose, had a tendency to work out of the plywood.

A Kansas City fabricator uses plastic rivets to fasten a hinge to the acrylic inspection door of a battery charger; here they do an efficient fastening job without cracking the sheet plastic material. A manufacturer of electroplating units uses the rivets to seal the device against tampering. If the seal has been broken, the service agreement is voided.

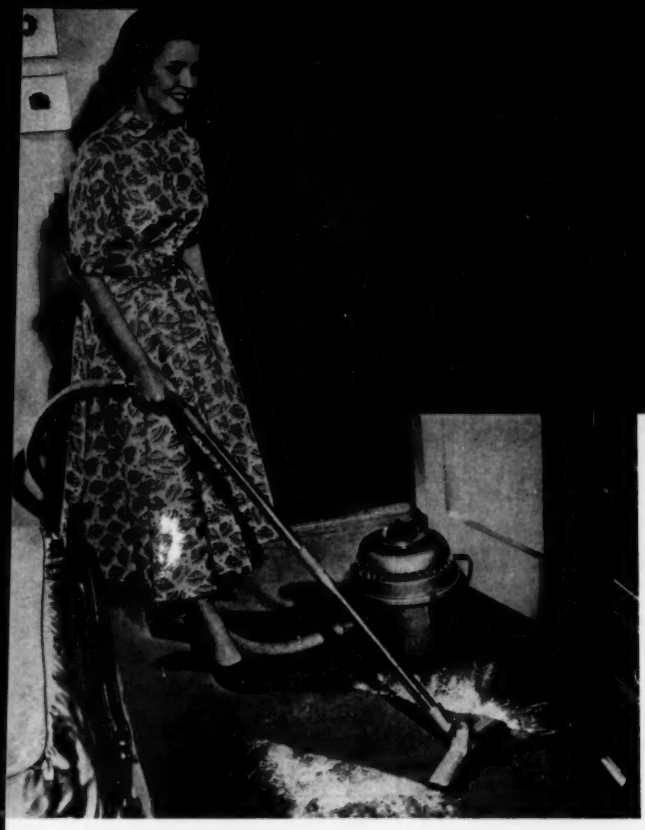
Plasti-Rivets work well for fastening name plates to various types of products. Here the color of the rivets can be matched to the color of the product and the one-shot fastening method speeds assembly. Drawer pulls for kitchen cabinets, dressers and other pieces of furniture offer additional development opportunities. Using a specially designed Plasti-Rivet with the head of the rivet enlarged to form the pull or knob, the knob may be fastened quickly and securely to the drawer by expanding the rivet in blind holes. Polyethylene rivets, particularly useful in plastic fabricating because they are relatively soft and will not crack the material, are also ideal for certain applications where the finished assembly is to be exposed to corrosive conditions.

Shakeproof Inc., believing that many important developments may be expected in plastic fasteners, is continuing development work with Plasti-Rivets. It employs two presses of its own—a 9-oz. HPM and a 4-oz. Lester—but has a large part of its requirements supplied by custom molders. By keeping this program active, the company intends to maintain its position as "fastening headquarters."

Test Data—Plasti-Rivets[a]

Plastic-Rivet shank diameter	*Ultimate tension*	*Single shear*	*Double shear*	*Recommended maximum constant load*		*Recommended maximum intermittent load*	
				Tension	*Shear*	*Tension*	*Shear*
in.	*lb.*	*lb.*	*lb.*				
1/8	45	55	100	10	15	20	35
3/16	100	162	300	25	40	65	100
7/32	140	210	425	35	55	90	140
1/4	200	287	531	50	75	125	175
3/8	350	650	1300	85	165	200	400

[a] Rivets tested to obtain the data were made of Du Pont Nylon FM-10001. The data given in the table is based on the average of a suitable number of tests.



Vacuum cleaner now has up to 23 parts made of plastics. Reinforced polyester is used as an alternate material for steel for the three parts of the tank

IN recent months, Lewyt Corp., Brooklyn, N.Y., has adopted plastics for 16 vacuum cleaner parts formerly made of steel, aluminum, zinc, or rubber. Shortages of these materials was the original reason for the shift to plastics, but experience has given Lewyt far better arguments for using plastics. As a result, most of the replacement parts will continue to be made of plastics after the original materials become easily available.

The primary arguments for using plastics which have emerged from Lewyt's experience with its "substitution" program are the savings in costs and weight made possible by the use of plastics. Weight is, of course, a primary factor in an appliance which must often be lifted and carried by the housewife. In some of the applications, the plastics parts have also proved more satisfactory than the metal parts they replace because of their smoother finish, quietor operation and/or molded-in chip-proof color.

There are also some plastics parts which cost more than the parts they replace—but some of these are considered sufficiently superior to justify the difference in costs.

In addition to the 16 replacement parts, there are seven parts (all of them attachments rather than part of the cleaner proper) which Lewyt has always made of plastics. The materials used in the 23 parts now being made of plastics include: cellulose acetate, phenolic, styrene, vinyl, ethyl cellulose, and glass mat reinforced polyester.

Cost Savings

Half of the replacement parts are being molded of cellulose acetate and most of them will stay in the Lewyt cleaner regardless of the availability of metal. For example, the air diffuser (Fig. 2) formerly die cast of an aluminum alloy, weighs half as much when molded of acetate, has a better finish and appearance, and costs 11% less. This part, which is partly visible on the exterior of the cleaner, is molded of gray acetate to match the other exterior parts.

The other acetate parts which have won a place in the Lewyt cleaner because of their merits and low cost rather than their availability are: the inlet fitting, nozzle elbow, and brush control indicator (Fig. 3); the handle (Fig. 4); and the rug nozzle (Fig. 5). The same is true of the phenolic spray gun body (Fig. 4).

The handle is a particularly interesting piece. Instead of die-cast aluminum, it is now being made of gray acetate with a molded-in metal core. The acetate handle is less than half the weight, just as strong, has a better appearance and feel, does not get hot to the touch when the motor runs for a long time, and costs 45% less than the aluminum handle.

Adopted Despite Costs

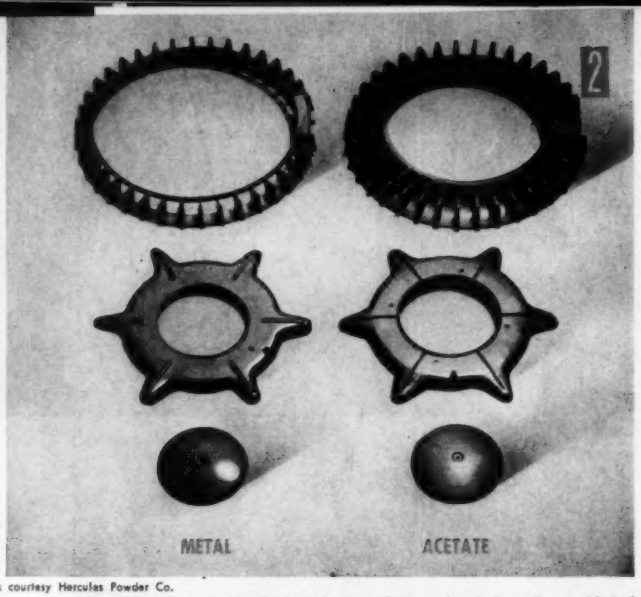
The injection molded plastic parts which cost more than the parts they replace include: the motor support ring and motor support disk (Fig. 2), the nameplate (Fig. 4), and the elastomeric vinyl parts (Fig. 6). Of these pieces, the one which is furthest out of line on costs is considered to be well worth the difference.

The nameplate is molded of transparent styrene and then sprayed and metallized on the back. This makes the piece so much more attractive than an aluminum stamping that Lewyt will continue to use the styrene part despite the fact that it costs twice as much as a metal stamping.

The vinyl parts are considered slightly more satisfactory than rubber and may possibly continue to be made of plastic. The motor support ring and disk, however, are considered only stop-gap applications and will return to steel when supplies permit.

The greatest savings in weight result from the use of glass mat reinforced polyester instead of steel for three large parts: the dust bowl, middle shell, and inner shell (Fig. 1). In steel, the three parts weighed a total of 5.93 lb.; in plastic, they weigh only 1.66 pounds!

It is interesting to note that Lewyt is actually saving more steel than



All photos on these two pages courtesy Hercules Powder Co.

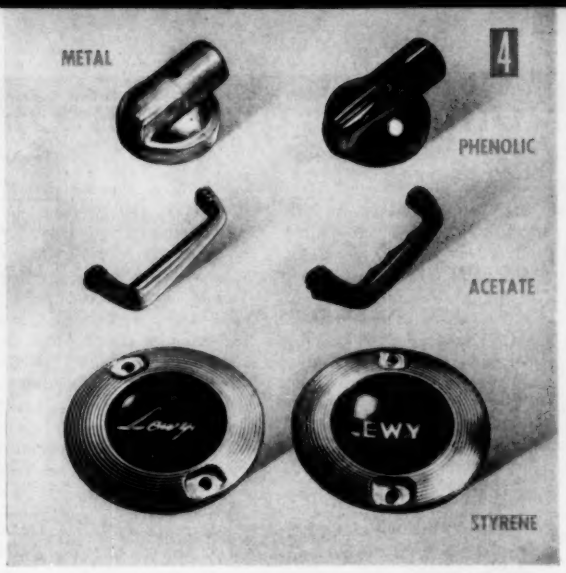
Three tank parts weigh 5.93 lb. when made of steel but only 1.66 lb. in reinforced polyester

Air diffuser (top) has a better finish, is better looking, and costs less when molded of plastic instead of made of metal. Motor support ring and disk are also acetate now

PLASTICS VS ~~NON-~~PLASTICS IN LEWYT VACUUM CLEANER

PHOTO NO.	PART	ORIGINALLY MADE OF	NOW MADE OF	WEIGHT SAVING	COST OF PLASTIC	SUPPLIER OF PLASTIC PART
1	Dust Bowl	Steel	Reinforced Polyester	75%	86% more	Molded Resin Fiber Co., Ashtabula, Ohio, and Auburn Button Works, Inc., Auburn, N.Y.
	Middle Shell	Steel	Reinforced Polyester	70%	81% more	
	Inner Shell	Steel	Reinforced Polyester	68%	100.5% more	
2	Air Diffuser	Die-Cast Aluminum Alloy	Cellulose Acetate	50%	11% less	Hardy Plastics & Chemicals, Inc., Brooklyn, N.Y.
	Motor Support Ring	Steel	Cellulose Acetate	None	20-25% more	
	Motor Support Disk	Steel	Cellulose Acetate	None	20-25% more	
3	Inlet Fitting	Aluminum Stamping	Cellulose Acetate	None	15-20% less	Hardy Plastics
	Elbow, Nozzle	Die-Cast Aluminum	Cellulose Acetate	43%	62.5% less	Welch Plastics & Mfg. Co., Inc., Columbus, Ohio
	Brush Control Indicator	Die-Cast Zinc	Cellulose Acetate	50%	50% less	Hardy Plastics
4	Spray Gun Body	Die-Cast Aluminum Alloy	Phenolic	10%	25% less	Norton Laboratories, Inc., Lockport, N.Y.
	Handle	Die-Cast Aluminum	Cellulose Acetate with Molded-in Metal Core	60%	45% less	Hardy Plastics
	Nameplate	Aluminum Stamping	Styrene	Negligible	100% more	Hardy Plastics
5	Rug Nozzle	Die-Cast Aluminum	Cellulose Acetate	50%	36% less	Hardy Plastics
6	Bumper Gasket	Rubber	Vinyl	Negligible	64% more	Welch Plastics
	Dusting Brush Holder	Rubber	Vinyl	Negligible	16.5% more	Welch Plastics
	Cord Strain Grommet	Rubber	Vinyl	Negligible	25% more	Welch Plastics
7	Floor and Wall Nozzle	Ethyl Cellulose		....	.....	Commonwealth Plastics Corp., Leominster, Mass.
	Demother Body and Cap	Cellulose Acetate		....	.....	Celluplastic Corp., Newark, N.J.
	Drapery Nozzle	Ethyl Cellulose		....	.....	Commonwealth Plastics
	Drapery Nozzle Grid	Cellulose Acetate		....	.....	Commonwealth Plastics
	Crevice Tool	Cellulose Acetate		....	.....	Hardy Plastics
	Carpet Nozzle Bumper	Vinyl		....	.....	Hungerford Plastics Corp., Murray Hill, N.J.

Acetate inlet fitting (top) does not have sharp edges and does not vibrate as did aluminum part, which cost more

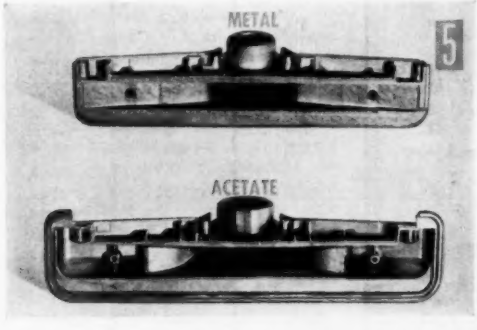


Phenolic spray gun body is lighter than metal and costs less. Acetate handle has better finish and feel. Styrene nameplate costs more but is more beautiful

would be indicated by these figures. The dust bowl, for example, weighs 2.68 lb.—but it takes 4 lb. of steel to make the part. Lewyt actually saves itself well over 8 lb. of steel for each set of polyester parts it uses.

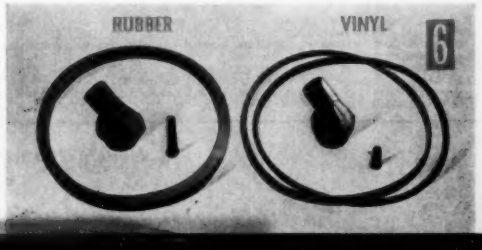
Aside from the question of weight, the polyester parts are stronger than steel, chip-proof, and dent-proof, and serve as acoustical insulation so that the cleaner is quieter in operation.

Unfortunately the polyester parts have one disadvantage: price. They cost from 81% to over 100% more than the steel parts. Thus Lewyt is continuing to make the metal parts as supplies permit and is filling in the rest of the production run with polyester pieces. The metal and polyester parts are completely interchangeable. Should steel become easily available, Lewyt will stop making the plastic parts. On the other hand, if the price of the polyester parts should become competitive with that of the steel parts, Lewyt will probably shift the entire production to glass mat reinforced polyester.



Acetate rug nozzle replaced heavier, costlier aluminum alloy part with only minor alterations in its design

Parts formerly made of rubber have better color and finish when molded of elastomeric vinyl, but cost more



Four acetate parts, two ethyl cellulose parts, and the vinyl bumper have always been made of plastics

Table I—United States Production and Sales of Plasticizers, 1950

Chemical	Production	Sales		
		Quantity	Value	Unit value
	1000 lb.	1000 lb.	$1000	Per lb.
GRAND TOTAL	242,553	186,650	64,990	$0.35
PLASTICIZERS, CYCLIC				
Total	179,867	136,665	46,290	.34
Oleic acid esters: tetrahydrofurfuryl oleate	709	378	218	.58
Phosphoric acid esters:				
Tricresyl phosphate	15,311	15,516	4,729	.30
Triphenyl phosphate	6,212	——	——	——
Phthalic anhydride esters, total	142,582	104,250	35,861	.34
Dibutyl phthalate	19,788	13,584	4,033	.30
Diethyl phthalate	16,054	10,509	2,482	.24
Di-2-ethylhexyl phthalate	60,537	44,734	16,754	.37
Di-iso-octyl phthalate	2,595	2,837	1,035	.36
Dimethyl phthalate	3,767	3,611	817	.23
Dimethyl Cellosolve phthalate	1,810	——	——	——
All other[1]	38,031	28,975	10,740	.37
All other cyclic plasticizers[2]	15,053	16,521	5,482	.33
PLASTICIZERS, ACYCLIC				
Total	62,687	49,985	18,700	.37
Adipic acid esters, total	5,965	3,374	1,368	.41
Di(2-ethylhexyl) adipate	1,975	——	——	——
Di-iso-octyl adipate	1,206	——	——	——
All other[3]	2,784	3,374	1,368	.41
Lauric acid esters, total	925	614	229	.37
Diethylene glycol monolaurate	744	——	——	——
Polyethylene glycol dilaurate	99	——	——	——
All other[4]	82	614	229	.37
Oleic acid esters, total	7,401	4,100	1,252	.31
Diethylene glycol mono-oleate	651	392	109	.28
Glyceryl mono-oleate	1,484	844	231	.27
Polyethylene glycol mono- and dioleate	431	190	78	.41
All other[5]	4,835	2,674	834	.31
Phosphoric acid esters[6]	4,887	4,266	1,783	.42
Sebacic acid esters: dibutyl sebacate	2,258	——	——	——
Stearic acid esters, total	17,158	15,554	4,974	.32
Butyl stearate	1,904	1,674	503	.30
Glyceryl monostearate	9,373	8,144	2,613	.32
All other[7]	5,881	5,736	1,858	.32
All other acyclic plasticizers[8]	24,093	22,077	9,094	.41

[1]Includes data for phthalic anhydride esters of phenols, cyclohexanol, fatty alcohols, mono-, and dihydric alcohols, Cellosolves, and phthalyl glycolates.

[2]Includes data for synthetic camphor, coumarone-indene, toluene sulfonamides, esters of benzoylbenzoic acid, and other cyclic plasticizers.

[3]Includes data for adipic acid esters of Cellosolves, monohydric alcohols, and glycols.

[4]Includes data for lauric acid esters of Cellosolves, and mono-, di-, and polyhydric alcohols.

[5]Includes data for methyl, ethyl, and butyl oleates, n-propyl oleate, glyceryl trioleate, glyceryl diacetyltartrate mono-oleate, and oleic acid esters of other alcohols and Cellosolves.

[6]Includes data for tributyl phosphate, triethyl phospate, trioctyl phosphate, and phosphoric acid esters of Cellosolves.

[7]Includes data for stearic, monohydroxystearic, and chlorinated stearic acid esters of monohydric alcohols, glycols, and Cellosolves.

[8]Includes data for esters of azelaic, citric, maleic, pelargonic, propionic, ricinoleic, sebacic, tartaric, and other acids.

Plasticizers Reach Big Volume

ONE of the quietly but rapidly growing materials used in the plastics industry, plasticizers zoomed from a production volume of not much over 100 million lb. in 1946 to an amazing total of 242 million lb. in 1950, according to the U. S. Tariff Commission's annual report. Estimators forecast that there will be at least 20% more in 1951. Furthermore, the government figures reported in Table I (opposite page) do not include the polyester type nor the petroleum derivatives sometimes used in large quantity as both plasticizers and extenders.

This rapid growth has been largely stimulated by the ever-growing uses of vinyl chloride and copolymer resins which require roughly a little over 100 lb. of plasticizers for every 200 lb. of vinyl processed. The variation ranges from film where the plasticizer content is around one-third of total weight and surface coating resins which require very little plasticizer to some types of wire coating and floor coverings that may use around 50% of plasticizer and fillers or extenders. In the overall picture, the percentage of plasticizer to resin seems to be on the increase.

Segregation of Figures

Table II represents an effort to segregate the plasticizers used in vinyls from the total amount of plasticizers produced, as reported in Table I. Table II, of course, is an estimate, but it was made only after lengthy consultations with men whose business it is to know what's going on in the field. Although the figures may not be exact to the decimal point, they are representative enough to give a good picture of plasticizer trends.

The government figures are necessarily complicated and diverse because they must not divulge individual company production, and in this business there are many kinds of plasticizers produced by one company only. Consequently, these plasticizers have to be reported in combination with others of similar or near-similar types. Still another confusing factor is that the reporting companies often interpret the questionnaire on which they report in a different manner. A good example to illustrate this point is in the vinyl resin production reports: one company reports resin used in floor covering as sheeting; another reports it as miscellaneous. Similar situations exist throughout the chemical industry, but in plasticizer reporting the confusion is probably at its height.

In breaking down Table I to show the uses and differences in the plasticizers named there, it should be noted that the cyclic plasticizers are benzenoid; the acyclic plasticizers are non-benzenoid. "Primary plasticizers" is used as a term describing those which are most likely to be used alone, or as the major portion of a plasticizer blend, and "secondary" is applied to those which are more generally used to blend with primary plasticizers to impart some particular property—such as hand, drape, low temperature flexibility—to the finished goods.

Of the oleic acid esters, tetrahydrofurfuryl oleate is used as a secondary plasticizer, especially in plastisols. It is low cost and has low viscosity; is used primarily to impart low temperature flexibility to low-cost finished products.

Tricresyl phosphate, one of the oldest plasticizers, is used particularly in wire coating because of flame resistance. The three million lb. not used for vinyl were used largely in petroleum refining. Production of tricresyl in 1951 may reach 18 or 20 million pounds.

Triphenyl phosphate is also used for flame retardance, but not much in vinyls. Some of it is used in cellulose acetate for flame retardance, but the greatest proportion of it is believed to have been used in safety film for movies and cameras.

Dibutyl phthalate is used to some extent in plasticizing cellulose acetate compounds, but its largest use

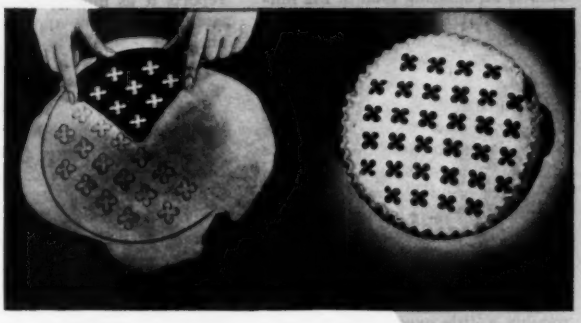
(Continued on p. 205)

Table II—Plasticizers (in pounds) Consumed by Vinyl Chloride and Copolymer Industry in 1950

Octyl phthalate plasticizers:	
Di-2-ethylhexyl (DOP); di-iso-octyl (DIOP); dicapryl, Goodrich and Hercules combination phthalate type	88,000,000
Other phthalate plasticizers	
Includes butyl cyclohexyl (Barrett 50B); butyl benzyl (Monsanto Santicizer 160); and various hexyl phthalates, and various phthalyl glycollates	4,000,000
Tetrahydrofurfuryl oleate	700,000
Phosphate plasticizers:	
Tricresyl phosphate	12,000,000
Other phosphates including trioctyl phosphate (Flexol TOF, Carbide); octyl diphenyl and cresyl diphenyl phosphate (Santicizers 141 and 140)	7,000,000
Low temperature and/or special purpose:	
Dioctyl sebacate; di-2-ethylhexyl adipate; di-iso-octyl adipate; SC (Drew); dioctyl azelate and glycol pelargonate (Emery's Plastoleins); ricinoleates; citrates; other miscellaneous special purpose types such as TWS that are unidentifiable by material content	25,000,000
TOTAL	136,700,000
Resinous plasticizers:	
Polyester type, made like alkyd resins	12,000,000

PLASTICS

Portable baby crib made of 12-gage vinyl has saran screening on all four sides for full ventilation. The top, which is zippered on three sides, also has a large screen panel. The crib, called the Carry-Crib, is light in weight and folds flat for storage. It has a light tubular steel frame which keeps the crib about a foot off the ground. Manufactured by Bunny Bear, Inc., Everett 49, Mass.

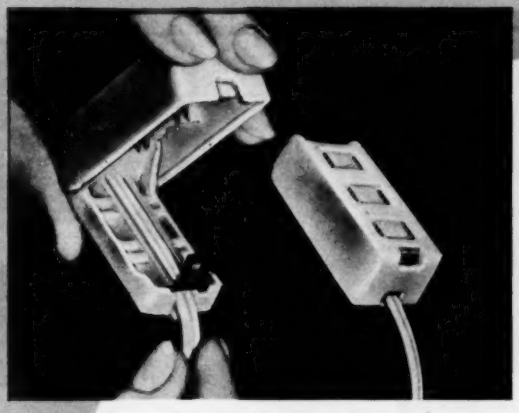


Cutter molded of red styrene can be used for making lattice pie tops. It eliminates the tedious job of cutting the dough into strips and then weaving them. The cutter is simply pressed into the rolled out dough. It cuts out eight clover-leaf shaped pieces from each quarter of the pie. The cut out pieces can be used with cheese or other garnishing to serve with drinks. Made by Kesco, 5614 Blackstone Ave., Chicago 37, Ill.

Needle threader made of Bakelite styrene is so simple to operate that it can be used to thread a needle in the dark. The device can be used to thread almost any size and type of thread on hand needles or sewing machine needles. The threader is less than 2 in. long, but it comes with a container and can be snap-fitted into a holder on top of the container for easier handling. Container is 3 in. high and 1½ in. in diameter. Made by Wink Needle Threader Co., 185 Clinton Ave., Brooklyn, N.Y.

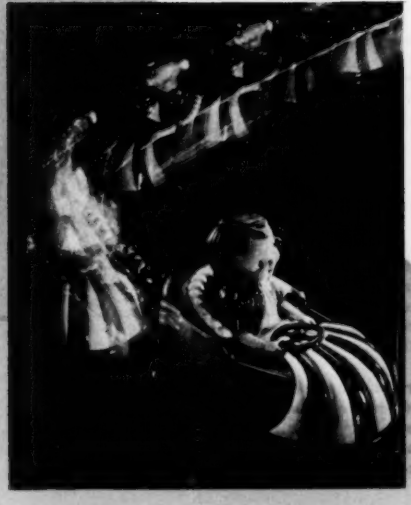
Toy parrot called Jolly Polly will perch on a stand or on a child's shoulder or can be held in the hand and made to perform. A finger-operated lever on the bottom of the parrot can be used to make it flap its wings and tail, open and close its beak, and emit a squawking noise. The toy can thus be made to snatch things and hold them in its beak. Both parrot and stand are molded of high impact styrene. Jolly Polly toy parrot is manufactured by Precision Specialties, Inc., 212 North Western Ave., Los Angeles 4, Calif.

PRODUCTS



Triple electrical outlet molded of urea can be attached to wire without stripping or slitting the wire, and without use of tools. The outlet is simply opened by pushing aside the spring latch and the wire is laid in a groove molded-in to the bottom half of the outlet. Metal prongs make the necessary contact when the outlet is snapped closed. The unit can be mounted on a wall or used as a table-top outlet for appliances. It is manufactured by Academy Electrical Products Corp., 3842 Ninth Ave., New York 34, N.Y.

Self-watering flower pot is molded of Bakelite styrene. The black pedestal base holds about a week's supply of water which is carried to the roots of the plant by a synthetic fiber wick. The pots are made in red, yellow, and copper-black by Quality Molding Co., 4541 W. Diversey Ave., Chicago, 39, Ill.



Toy dodgem car like those in amusement parks has wind up motor geared to make the toy do figure eights. Head of girl in the car wobbles as the car spirals. The car and rider are both molded of Hercules cellulose acetate and decorated in gay colors. Made by Irwin Corp., 200 Fifth Ave., New York, N.Y.

Bottle for mixing frozen fruit juices is molded of styrene. Tight friction-fitting lid prevents leakage while the bottle is being shaken. Molded-in fins break up hard pieces of frozen concentrate and aerate the juice. Bottle has 32-oz. capacity and can be used for mixing cocktails, salad dressings, or milk shakes. Manufactured by Kitchen Plastics, 1401 West Eighth St., Los Angeles 17, Calif.

PLASTICS

Mixing bowl molded of Melmac is durable and light in weight. Interior of the 10-in. diameter bowl is smooth and rounded so as not to interfere with the action of mixing spoon or electric mixer. The 3-qt. mixing bowl is molded in colorful spatter pattern by Plastics Mfg. Co., 825 Trunk Ave., Dallas, Tex.

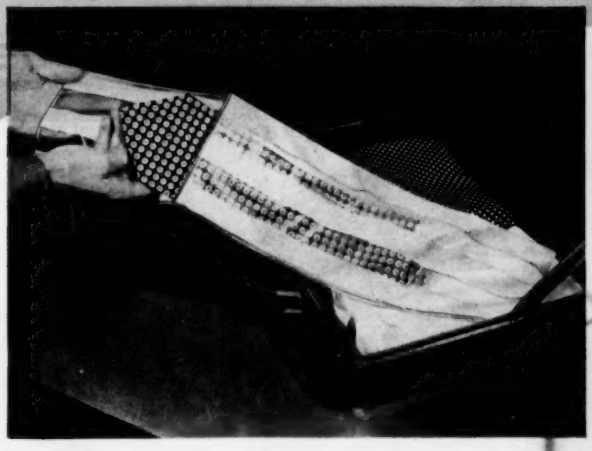
Water closet tank cover molded of Geon vinyl can be used to replace broken porcelain covers. Lugs which hold the cover in place can be screwed in to any of a number of holes molded into the underside of the cover. Thus it can be adjusted to fit any tank up to 21⅛ by 7⅝ inches. Made by Tybond Products Co., 2435 North Western Ave., Chicago, Ill.

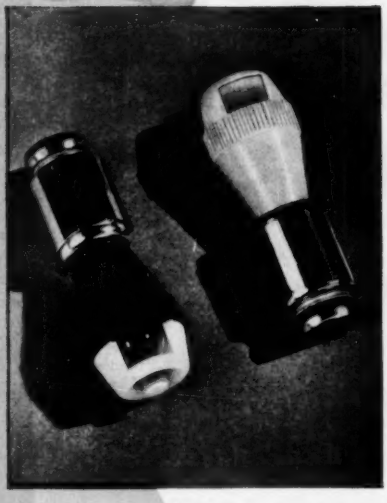
Inflatable hat-umbrella is made of Vinylite film. When needed, the hat can be taken out of the purse and the tubular rim inflated to make the hat as large as an umbrella. The wearer gets protection from the rain and both hands are left free for carrying packages. When not in use, the hat-umbrella can be deflated and takes no more space than a pack of cigarettes. Made by Rain Bonnet, 4121 Beverly Blvd., Los Angeles 4.

Bird cage molded of cellulose acetate has a toy canary and perch of the same material. Wind-up motor in the base of the 9-in. high cage makes the cage vibrate so that the bird whistles and swings on its perch. Manufactured by Irwin Corp., 200 Fifth Ave., New York, N.Y.

PRODUCTS

Combination cigarette lighter and dashboard light is molded of nylon. Unit fits into standard outlet. Lighter works when pushed in, snaps out when lit. Light works independently, is controlled by switch on end of the handle. Molded in combinations of black and natural nylon by Sinko Mfg. & Tool Co., 3135 W. Grand Ave., Chicago 22

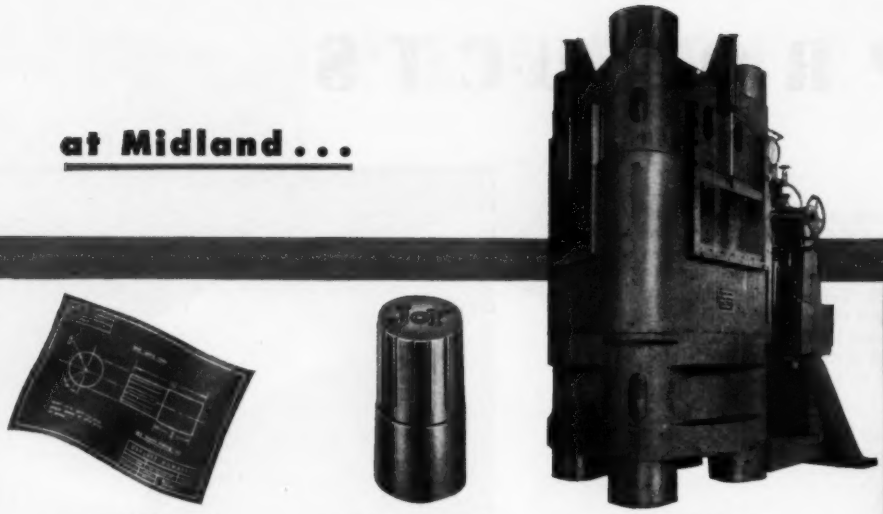




Handy, light-weight tie case for travelers consists of 30-gage clear acetate rack and 4-gage vinyl film case. Ties are folded in half and pulled through a slot die-cut in the rigid acetate rack. The rack is then slipped into the vinyl case. The transparent case with white stripes is attractive in appearance and keeps the ties clean. The whole unit takes little space and adds little to the weight of the luggage. Manufactured by Reba Kaldor, P.O. Box 236, Madison Square Station, New York 10, N.Y.

Relish set consists of eight serving dishes and a circular base with a handle. Dishes and base are both molded of styrene. Each dish can easily be detached for individual serving by tilting the dish up slightly and pulling it out. The unit is 17 in. in diameter and has chartreuse and forest green dishes and a brown base. Made by Superior Plastics Div., Commonwealth Plastics, Inc., 414-430 N. Oakley Blvd., Chicago 12, Ill.

at Midland . . .



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Practical Embedment of Flowers

Specific details of preservation methods, preparation of the casting plastic, embedment, cure, and finishing of pieces

by C. E. WRIGHT

A PRACTICAL process for the preservation of flowers and their embedment in plastic has been developed as a result of more than five years of laboratory work at the Engineering and Industrial Experiment Station of the University of Florida, Gainesville. The perfection of the process opens up a wide field for the manufacture of products for use in the scientific, novelty, and utilitarian trades. The process is not complex, and a production set-up does not require the employment of a large staff.

W. H. Beisler, Head Professor of Chemical Engineering at the University, says: "The production of novelties and costume jewelry by this process is one industrial possibility that appears to be attractive. Another application of the process would be in the production of specimens for herbaria, museums, schools, and colleges. Flower samples from all over the world may be processed and made available for display purposes or for scientific study."

* Reg. U. S. Pat. Office.

Reduced to Practice

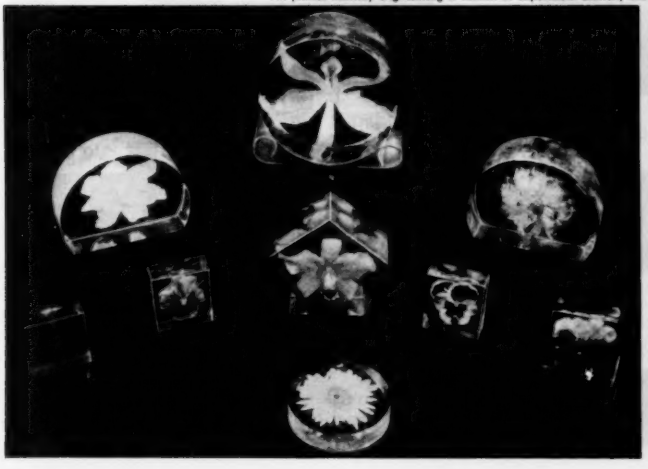
Woods Floral Art Co., adopting the University's technique, has started the manufacture of costume jewelry in which small pansies are embedded. After doing some introductory work at Gainesville, the company set up facilities at 611 E. Main St., Greenfield, Ind.

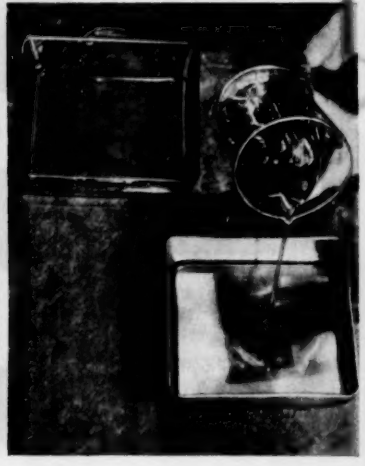
The process for preparing flowers for embedment and for embedding them was developed by Prof. Randolph C. Specht of the Chemical Engineering Department. The University first became interested in the project in 1945 when Dr. G. R. Fessenden of the Extension Service of the U. S. Dept. of Agriculture gave a short course at the University on the mounting of biological specimens between sheets of transparent plastic materials. The colors of the specimens were preserved

Examples of flower embedments produced by the process described in this article, showing several shapes which have been machined and different flowers that have been used

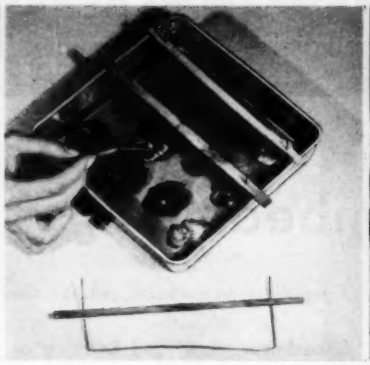
Pouring the base layer of thermosetting resin. This comprises about 60% of the finished casting

All photos courtesy Engineering & Industrial Experiment Station, University of Florida

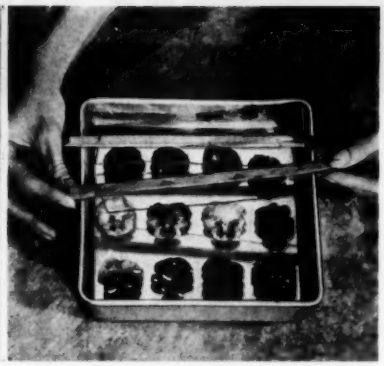




Flowers are placed face down on the liquid resin base and then turned over



Anchoring flowers in place in the mold to prevent lateral movement is done by a simple wire frame



Wire frame which prevents drifting to edges is removed as soon as casting resin sets to a gel

before mounting, but the preserved flowers lacked firmness and had to be pressed into two-dimensional form.

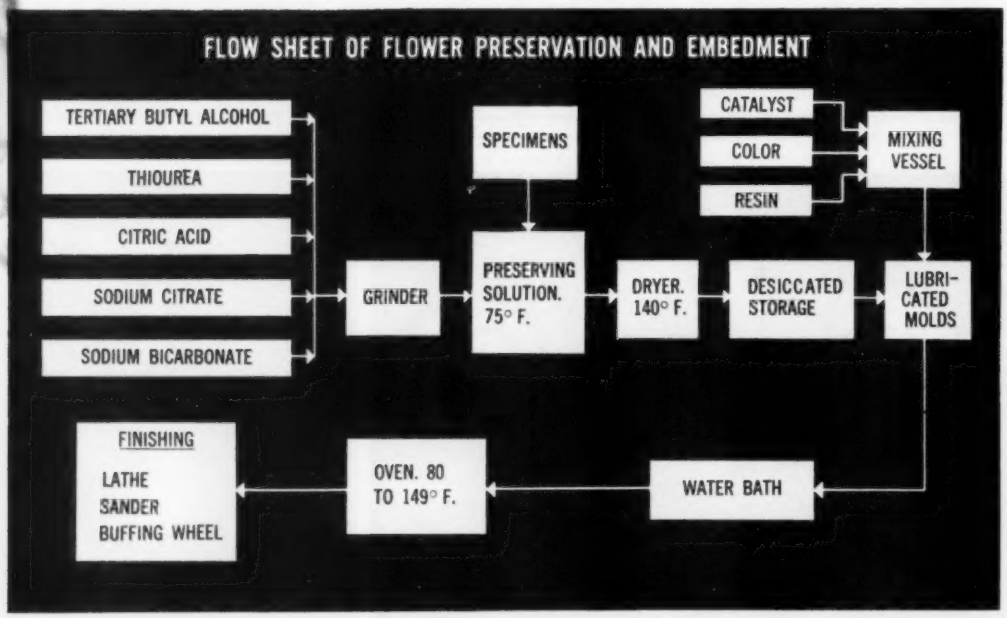
A research project was set up in June, 1945, to investigate the possibility of preserving not only the color but the shape of flowers. The successful results have recently been announced only after the Station was certain that the process was practicable and that the embedded flowers would retain their color and texture over long periods of time.

Steps in Process

Briefly, the process consists of the following steps: 1) selection of specimen; 2) preservation; 3) preparations for casting; 4) preparing the mold; 5) preparing the resin; 6) casting; 7) curing; and 8) finishing.

For commercial production, experience shows that it is advisable to select flowers which have thick petals that do not detach easily from the calyx. Perfect specimens should be selected, as any blemish in the flower will be exaggerated during the preserving process. The University has had its best results when flowers were immersed in the preserving solution immediately after cutting.

"Bright colored flowers are generally selected for treatment," according to a University spokesman, "for they show up much better in



the casting than those having pastel shades. Brilliant reds, vivid pinks, bright yellows, and deep blues embedded in the plastic are most appealing to the majority of people who have seen the embedded specimens."

As a result of experiments with more than 50 flowers, eight preserving solutions have been developed. Generally, colors ranging from red to pink are preserved in solutions having an acid reaction, while those ranging from green to blue require a solution having an alkaline reaction. The solutions that the Station has worked out are as follows:

No. 1) 1000 parts tertiary butyl alcohol, 10 parts thiourea, 20 parts citric acid.

No. 2) 1000 parts tertiary butyl alcohol, 10 parts thiourea, 20 parts sodium citrate.

No. 3) 1000 parts tertiary butyl alcohol, 10 parts thiourea, 20 parts sodium bicarbonate.

No. 4) 1000 parts tertiary butyl alcohol, 10 parts thiourea, 20 parts citric acid, 50 parts formaldehyde (40 percent).

No. 5) 1000 parts tertiary butyl alcohol, 10 parts thiourea.

No. 6) 1000 parts tertiary butyl alcohol, 100 parts peracetic acid (40 percent).

No. 7) 1000 parts tertiary butyl alcohol, 20 parts citric acid.

No. 8) 1000 parts tertiary butyl alcohol, 10 parts thiourea, 20 parts citric acid, 20 parts sodium sulfite.

While most flowers can be successfully preserved in either solution No. 1 or No. 2, some flowers require the use of the other solutions. If the color cannot be preserved in any one of the solutions, two or more of the solutions may be mixed in order to obtain the proper acidity or alkalinity.

Preservation Suggestions

The University offers the following suggestions, based on its experiments conducted in the field of flower preservation:

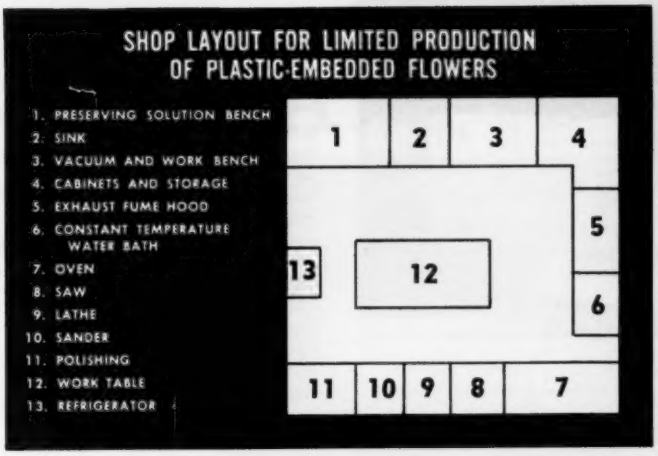
"Generally, specimens whose color ranges from pink to red are preserved in solution No. 1 and those whose color ranges from green to blue are preserved in solution No. 2. Some blues and greens may be treated in solution No. 3. Intermediate colors between red and blue may generally be preserved in either solution No. 1 or No. 2, or in a mixture of solution No. 1 in solution No. 2 in an amount so that the pH of the solution will be adjusted to the proper point at which the color is preserved. Certain reds may be preserved by treating the specimens in solution No. 2 followed by dipping in solution No. 1 until the desired color is obtained. Others may be treated in solution No. 7. Most orchids are best preserved in solution No. 5.

"Certain whites which have a tendency to turn to orange or brown may be treated in solution No. 4; however, best results may be obtained by dehydrating in solution No. 1 and then bleaching to white in solution No. 6. (When this solution is used, the specimens should be thoroughly dried over a desiccant, such as anhydrous calcium chloride, at room temperature so that all peracetic acid is removed and none will be present to catalyze the polymerization of the resin.)

"Solution No. 6 is generally used for bleaching flowers such as gardenias, orange blossoms, magnolias, and stephanotis. Some flowers may not respond in this solution, particularly the hybrid white roses and white camellias. Solutions Nos. 7 and 8 are suitable for many whites, and no further treatment is required. Certain white roses turn a beautiful yellow in solution No. 6; even bruised portions that have previously turned brown. When it is desired to bleach a colored flower, such as an orchid, the fresh flower should be placed in solution No. 6 without previous treatment."

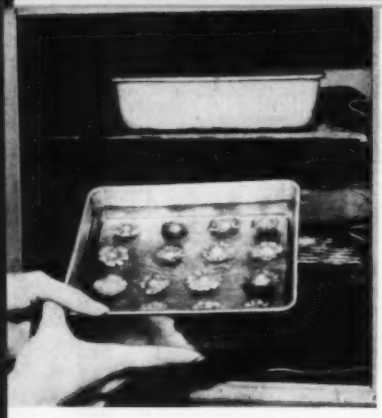
The University[1] offers the following advice regarding the chemicals used in preserving solutions: the

[1]A 30-page bulletin (Bull. No. 40, "Preservation of the Color and Shape of Flowers") is available for $1 from the Engineering and Industrial Experiment Station of the University of Florida, Gainesville, Fla.



Suggested equipment for shop includes: mechanical refrigerator; electric hot plate with adjustable temperature; fume hood equipped with exhaust fan; glass storage jars; vacuum pump or aspirator; tweezers and tongs of wood or plastic; assortment of florist wire and tape; dissecting needles; glass beakers and dishes; metal trays and enamelware for molds; thermometers; laboratory scales (0.1 to 1500 g.); routine laboratory implements; metal lathe; band saw; belt sander; buffing wheels; oven; and water bath

Top layer, about 40% of total resin used, is poured over gelled base layer



Oven for curing castings is cooled to room temperature before removing mold

Cured casting after removal from oven and before being removed from the mold

tertiary butyl alcohol melts at approximately 25° C. (77° F.) and in cool weather will be a solid cake, so that it is necessary to melt it before it is mixed. The chemicals may be ground to a fine powder to permit easy dissolving. In order to avoid caking of the chemicals, it has been found desirable to add them to the alcohol while stirring. It has also been found that all of the chemicals will not go into solution; the insoluble portions can be allowed to settle. The solution should be clear before the flowers are immersed. Dehydration of the specimens during immersion causes an increase in the water content of the solution so that more of the chemicals will go into solution as work progresses. When all are dissolved, the solution should be discarded, as spent solutions give poor color preservation. Care should be taken not to introduce water into the solutions either from dew on the flowers or from absorption of moisture from a humid atmosphere.

Time and Temperature

Specimens are immersed in the preserving solutions for periods ranging from 1 to 24 hr., depending on the texture of the petals. Thin specimens will require less time than thick or woody ones. The recommended temperature for the solutions is 21 to 24° C. (70 to 75° F.). If slightly lower temperatures prevail, from 50 to 100 parts of normal butyl alcohol may be added to lower the freezing point of the solutions. Good results were obtained at the University when specimens were left in the preserving solutions for about 20 hours. If the solutions are too warm, the flowers are likely to shrink or curl. Glass containers are recommended to permit observation during preservation. Wide, short containers have been found better than narrow tall ones.

Large flowers like orchids sometimes require support while in the solution. Such supports may be thin aluminum strips riveted together at one end so that each strip can be pivoted around the rivet and then bent to the desired shape.

Care must be taken in removing flowers from the solutions as they tend to become brittle. After removal, the flowers are quickly drained and then immediately placed in a drying oven maintained at 45 to 60° C. (113 to 140° F.). Temperatures over 65° C. cause charring of the flower petals. One to two hours drying time is considered sufficient. In place of oven drying, it was found at the University, drying can be done successfully at room temperature in a desiccator, the bottom of which is covered with a desiccant such as anhydrous calcium chloride. Large flowers such as orchids may require supports while drying; wads of cotton are satisfactory. After drying, the flowers are removed to storage boxes containing a desiccant, where they remain for at least 24 hr. so that all volatile material will be removed before they are embedded in plastic.

Casting Resin

Tests made at the University of the many resins available finally resulted in the selection of Selectron 5026, made by Pittsburgh Plate Glass Co., which was found "to be the most practicable from the standpoint of handling, workability, and suitability." This clear, transparent, fast-curing, thermosetting resin has a high refractive index, is light in color, and has excellent machining properties. A yellow color, noted in early experiments, was masked by the manufacturer by providing another color to give a light blue tint to the casting.

The catalyst which was most successfully used in the University experiments is tertiary butyl hydroperoxide. As this has a disagreeable odor and is flammable, it is recommended that it be mixed with the resin in a well-ventilated room or preferably under a hood. A cautionary note is also added that electrical fixtures should be of the explosion-proof type.

Proportions of Catalyst

Here are the University's instructions as to the amount of the catalyst to be used: "For castings which are less than ½ in. thick, as much as 0.45% tertiary butyl hydroperoxide, i.e., 5.0 ml. per 1000 g. of resin, may be used. For sections 1 in. thick, successful results have been obtained when using 40 drops (1.0 ml.) of the catalyst per 1000 g. of resin. For sections which are thicker than 1 in., 20 or 30 drops of catalyst are added per 1000 g. of resin."

Other catalysts which were used successfully include Lucidon benzoyl peroxide, Luperco ATC paste type, and organic peroxide. (Lucidol Div., Novadel-Agene Corp., Buffalo, N.Y.)

Molds Used

As soon as all air bubbles have risen to the surface, the catalyzed resin is ready to be poured from the mixing vessel into the molds, which, of course, have been prepared in advance. The University experimenters have used molds of glass, enamelware, glazed earthenware, and metal, but prefer glass because of its transparency; they recommend a thin film of kerosene for a mold lubricant. If a silicone is used as a mold release agent, it must be applied in a very thin film and any excess removed with a soft cloth. Dow DC mold release has been used.

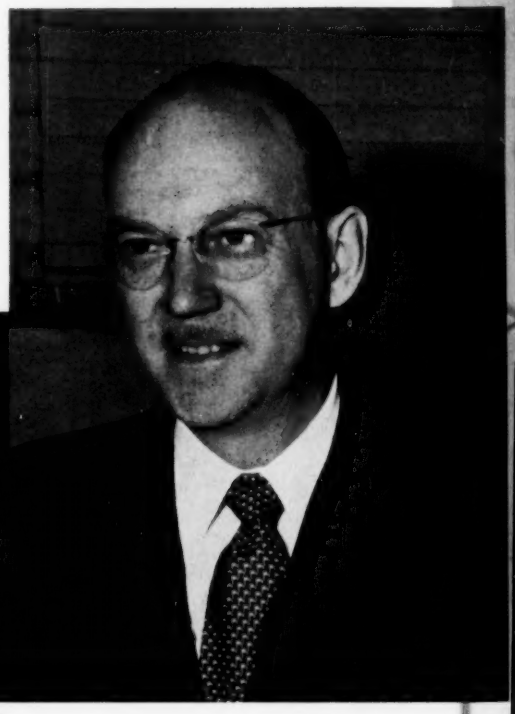
One of the most ticklish parts of the operation is placing the preserved flowers in the liquid resin. Flowers may be removed from

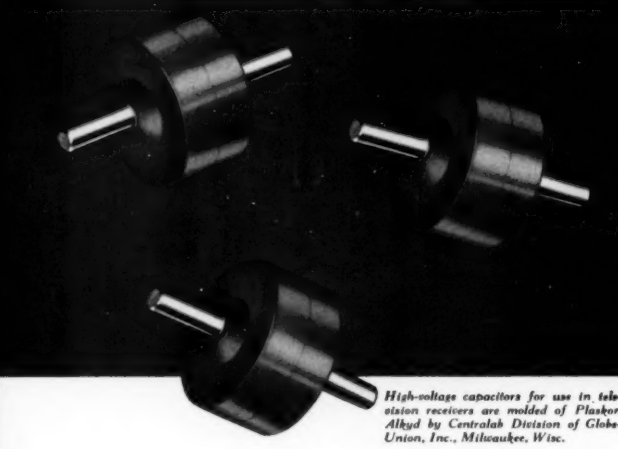
(*Continued on p. 121*)

"PLASKON ALKYD

has at least doubled the productive capacity of our molding equipment"

says Mr. W. S. Parsons,
Vice-President
CENTRALAB DIVISION OF GLOBE-UNION, INC.





High-voltage capacitors for use in television receivers are molded of Plaskon Alkyd by Centralab Division of Globe-Union, Inc., Milwaukee, Wisc.

Like so many manufacturers, Centralab Division of Globe-Union, Inc., received substantial rewards in a hurry from a simple switch to Plaskon Alkyd Molding Compounds. And probably the most important of these was an increase in the productive capacity of molding equipment amounting to at least 100%. Mr. W. S. Parsons, Centralab vice-president, also reports "life of molding dies has increased" . . . "a very appreciable labor saving."

now turn the page for ----------

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ALKYD

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2121 Sylvan Avenue • Toledo 6, Ohio
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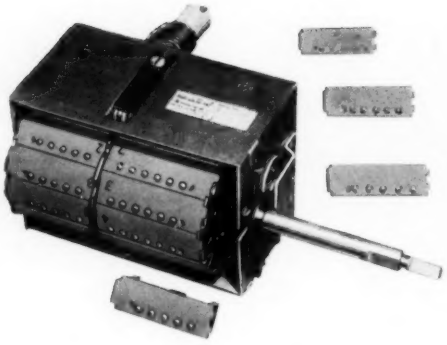
Manufacturers of Molding Compounds, Resin Glues, Coating Resins

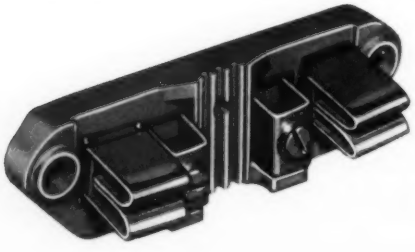
16 PRECISION PARTS EVERY 30 SECONDS! Here is an outstanding example of the high-speed production possible through the use of quick-curing Plaskon Alkyd. And these parts used in television tuners must be held to precision tolerances as close as .0005". Molded for Standard Coil Products Co., Chicago, by Wilcox Plastics, Los Angeles; Mayfair Molded Products Co., Chicago; P. R. Mallory Plastics, Inc., Chicago; and Central Molded Products, Chicago.



HIGH-SPEED MOLDING YIELDS BIG SAVINGS! Sangamo Electric Company, Springfield, Ill., achieved a new high-production molding record turning out Plaskon Alkyd parts for its motor starting capacitors on a battery of 13 small presses. Sangamo has reported: "This speed really shows up where it counts most — in savings!"

more evidence of increased production with PLASKON ALKYD

FASTER PRODUCTION CONTRIBUTES TO 50% COST SAVING! Barber-Colman Company, Rockford, Ill., realized a saving of 50% in unit cost when it switched to Plaskon Alkyd for molding parts for rotors used in J. I. Case tractors. And the higher production rate achieved with Plaskon Alkyd was an important contributing factor!



HIGH PRODUCTION RATE ON AUTOMATIC PRESSES! Molding its watt-hour meter bases with Plaskon Alkyd, Blakeman Bros. Electric Mfg. Co., Los Angeles, cites the following results: "We have found that Plaskon Alkyd lends itself very well to automatic molding, giving us a high production rate on automatic presses."

WOULD

300 to 400%
faster molding of parts

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From a wide variety of applications comes mounting evidence that Plaskon Alkyd can be molded *three to four times faster* than conventional thermosetting molding materials with appropriate modification of molding equipment. Molder or manufacturer . . . if you have any small parts which lend themselves to compression molding, here could be the way to step up their production tremendously!

And the amazing, quick-curing plastic which has created new concepts of speed in compression molding helps in other ways to improve profit figures. It can be molded on high-speed automatic machines, saving labor. It can be molded at lower pressures with simpler dies. And it can improve the general efficiency of molding room operation because it is less sensitive to variations in pressure, temperature and time.

Thanks to its remarkable properties, particularly its electrical properties, Plaskon Alkyd can be successfully used in parts which it was never before practical to make of plastics. And it can improve the performance of many parts now made of conventional thermosetting materials!

Investigate Plaskon Alkyd more completely—*now.*

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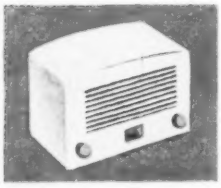
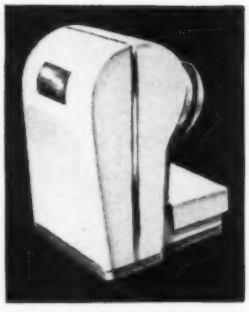
TURN THE PAGE FOR NEWS OF ANOTHER PLASKON MOLDING COMPOUND ➤

Housing Problems?



18 of the 28

proved benefits of Plaskon molded color help make housing better!



EACH ONE of the 28 desirable properties of Plaskon Molded Color has proved itself a benefit in the manufacture of certain products. Naturally, the amazing diversity of these properties makes it impossible for any one product, or any single line of products, to utilize *all* of them to advantage. But it's surprising how many products can utilize a *majority* of these proved benefits of Plaskon Molded Color! In the compression molding of housings, for example, here are 18 reasons why Plaskon Molded Color can help make them better:

Economical to use
Light in weight
Wide range of translucent and opaque colors
Permanent, non-fading solid colors
Color uniformity
Smooth, non-porous easy-to-clean surface
Won't tarnish or corrode
High flexural strength
High tensile strength
Resistant to chipping, checking or shattering
Dimensional tolerances highly accurate
Non-conductor of electricity
High heat resistance
Low-heat transference
Non-inflammable
Resistant to dilute acids and alkalies
Unaffected by oils, fats, greases, waxes
Completely resistant to commercial solvents

Whatever your product, it may pay you to discover how many of the *28* desirable properties of Plaskon Molded Color—Urea or Melamine Formaldehyde—can help to make it better.

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PLASKON
MOLDED COLOR

storage and placed in the mold either before or after the resin has been poured, but should be kept out of humid atmosphere since they will rapidly absorb moisture and lose their shape. When placed in the resin, flowers must be anchored until resin gels, or they will float.

The Experiment Station recommends the use of weights to hold flowers in place in the resin; when this is done, it is necessary to cut off the portion of the casting containing the weight to make an attractive casting. A convenient weighting material is lead in strip form. A strip is attached to the flower stem before immersion. If the lead base is cut off after casting, the ends of the flower stems will be exposed at the surface of the cut; it is then necessary to cut or drill the plastic and stems to a depth of approximately ¼ in. and then fill the opening with a quick-setting cement. If this precaution is not taken, moisture will enter the casting through the stem and cause later deterioration of the embedded flower.

Placing the Flowers

When a large number of small pieces are to be made, a recommended procedure is to pour a layer of catalyzed resin into the prepared mold to a depth of about 60% of the finished embedment. The preserved floral specimens are then dropped, one by one, on this bottom layer of liquid resin, face down. They are then turned face up, using a bent wire or two-pronged fork to turn each flower slowly on edge, after which it is allowed to tip over by its own weight. If an air bubble is entrapped, it may be removed by pushing down on the petal on which the bubble is entrapped and holding it there a few seconds until the bubble rises and escapes.

After the flowers are turned over, they tend to drift toward the edges of the container and must be held in place laterally. A simple method of doing this is to provide thin strips of wood, a little longer than required to span the mold, with adjustable wire frames slipped into snug-fitting holes. These strips and frames are shown in accompanying photos. In use, the wire frame is adjusted so that, when the wood strip rests on the edge of the mold, the wire just touches the surfaces of the floating flowers, preventing them from moving sideways.

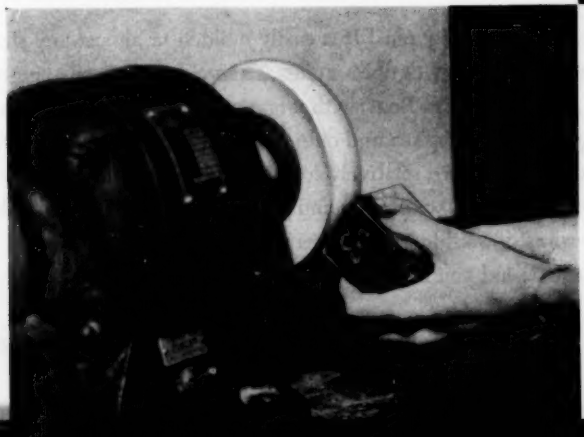
The wires are removed as soon as the resin has set to a gel. It is not necessary to wait until the base layer is completely polymerized before pouring the top layer. Only enough resin is needed for the top layer to cover the flowers and allow for facing. In the case of small flowers such as pansies the bottom layer will be about 60% and the top layer 40% of the desired casting.

After being allowed to set for about 15 hr. in a constant-temperature water bath, the casting is ready for the oven, which is at room temperature when the casting is placed in it and then slowly heated to 65° C. (149° F.). For small castings a temperature increase of 20° C. per hour is considered to be quite safe. The oven is allowed to cool to room temperature before the castings are removed.

The castings are now ready for the finishing operations, such as sawing into blocks with a bandsaw; forming into circular shape with a lathe; squaring up the vertical faces and edges with a sander; and polishing on a buffing wheel.

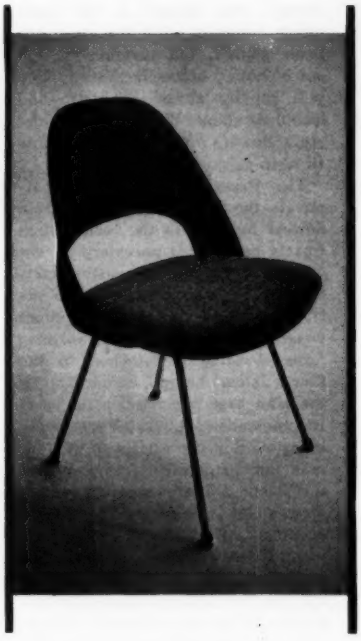
Casting is cut in sections, which can be faced or turned to shape on a lathe

A belt sander is used to square up the four vertical faces of this cast piece



Completed casting receives final finish by polishing on a buffing wheel

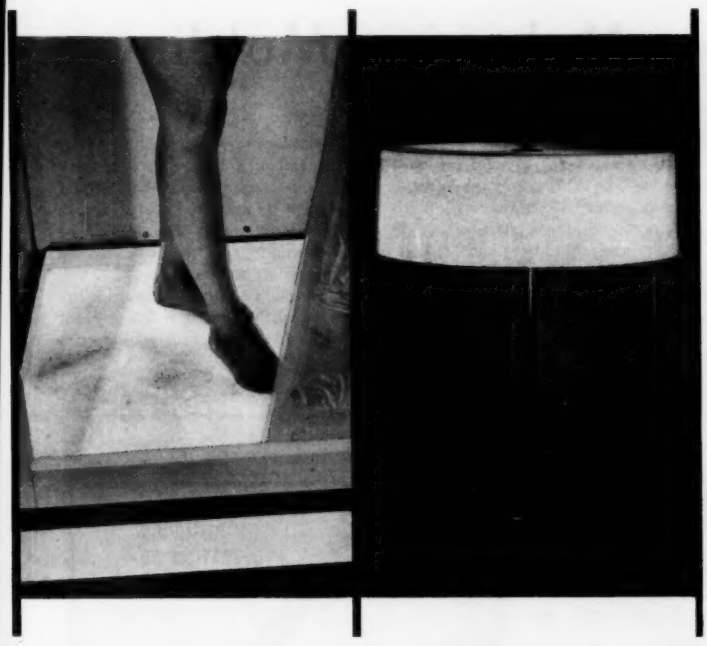
all this ...



LAMINAC is easy to mold in almost any shape. The back of this chair is a fine example. Color is permanently molded in—no painting or refinishing needed. (Chair produced by Knoll Associates, Inc.)

and more, with Laminac® resins

LAMINAC resin is versatility plus! It is easily molded in almost any shape or size... *in one piece.* Reinforced with fibrous glass, LAMINAC resin is amazingly resistant to impact. An Army Storm Boat, with a one-piece hull made from this material, has been dashed out of the sea and onto a rocky beach with only superficial damage. Tooling costs are relatively low, too. Because little pressure or heat is needed to mold LAMINAC, presses and molds cost less... and slash the time required to transform a blueprint into a salable part.
We'll be glad to send you more data!



LAMINAC is lighter than aluminum, with a strength/weight ratio higher than steel. This LAMINAC shower receptor weighs 20 lbs., compared with 300-400 for terrazo, 80 for steel. (Molded for Kaytel, Inc., by Molded Resin Fibres, Inc.)

LAMINAC transmits light without glare, has an interesting texture. And a quick wipe with a damp cloth whisks away dirt and grime. (Lamp reflector molded by Northern Industrial Chemical Co. for Lam Workshop, Inc.)

We may be able to help you meet military specifications where plastics and resins are concerned. What's your problem?

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Machining a Melamine Molding

by JASPER BAUM*

ONE of the big advantages of producing a product by molding is that it is usually possible to complete all of the details, from the standpoint of both beauty and engineering, in the molding operation. On some jobs, however, an intricate, costly, and slow operating mold would be necessary to mold the undercuts, slots, holes, and other features necessary to complete a given part in the molding operation.

Such an intricate mold would have to be equipped with various moving cams, plugs, and separate mold parts, which must be actuated by externally mounted hydraulic or air cylinders or by the motion of the press. Hence it would be necessary to use a larger press than would normally be required. As a result, the molding operation would be slower and the press overhead charge would be higher.

When such an intricate mold is indicated by the design of the piece, it is advisable that the proposed part

* Sonotone Corp.

In the production of a molded melamine hearing aid frame, it was found more economical to machine rather than mold-in certain details. The preparation and assembly steps involving machining are indicated here and shown in detail on the two following pages

All photos courtesy American Cyanamid Co.

FRAME ASSEMBLY
BATTERY SPRING CONTACTS OPERATIONS 10A & 10B
SPUN BUSHINGS OPERATION #9
(3) EYELET LUGS OPERATION #8
(2) SPUN BUSHINGS OPERATION #9
(12) EYELETS OPERATIONS 10A & 10B
FRAME PREPARATION
UNDERCUT RECESSED SLOTS OPERATIONS #4 & 5
ELONGATED OBLONG OPENING OPERATION #3
(2) DRILLED HOLES OPERATION #6
GATE REMOVAL OPERATION #1
(2) DRILLED HOLES OPERATION #7
(2) UNDERCUT RECESSED SLOTS OPERATION #4
CORNER SAW SLOT OPERATION #2

planting trees with tractors to make fibres for industry

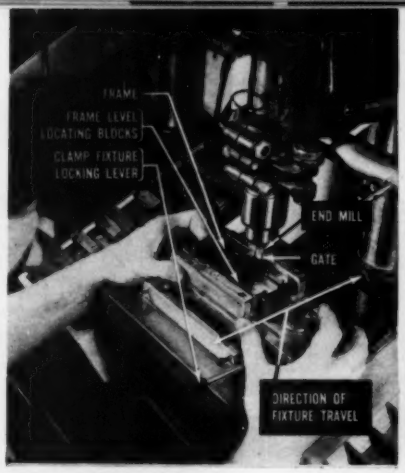
With this MOSINEE Tree Planter, 1500 or more seedlings can be planted per hour! It *completes* the planting operation . . . even tamps the seedlings into the ground.

This is the beginning of a 30 to 40-year cycle during which seedlings grow to matured trees, ready for harvesting. They then will provide the kind of fibres needed for many products of industry.

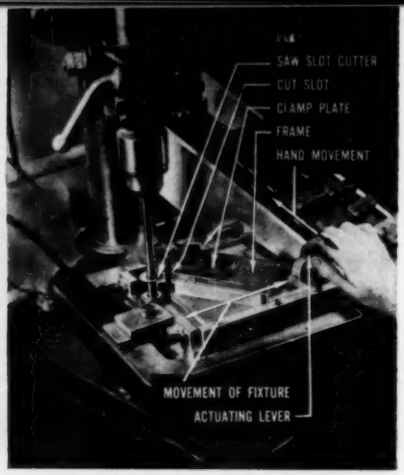
From seedlings to technically controlled industrial paper, MOSINEE safeguards every step in the process of making MOSINEE fibres that work for Industry

MOSINEE PAPER MILLS COMPANY, Mosinee, Wisconsin

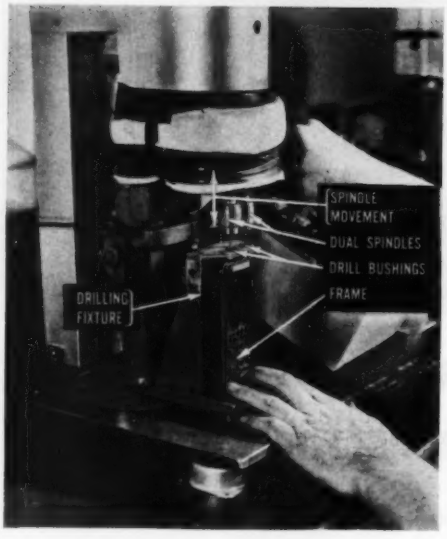
MOSINEE makes fibres work for industry



Right: Operation #1—Gate removal. Clamping fixture holds frame in position and locates gate on top of frame edge level with end of milling cutter. As fixture is moved front to back by hand, gate is removed by the rotating cutter. Gate removal must leave a smooth surface on recessed edge of the frame to provide a uniform joint with mating edge of the metal case



Above: Operation #2—Corner slotting. Clamping fixture holds frame in position, locates it properly for cutting thin saw slot in frame corner at required level. Fixture is moved right to left to feed frame into cutter



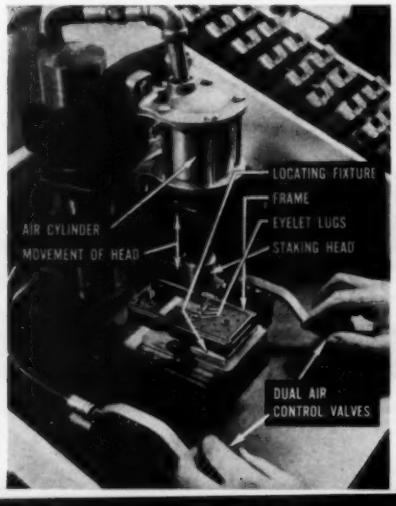
Operation #6—End hole drilling. Drilling fixture locates frame. Bushings in fixture assure precision location of holes drilled simultaneously by dual spindles

be carefully studied by the molder's engineering department; it may be possible that some or all of the undercuts, holes, and other details can be more economically machined than molded-in.

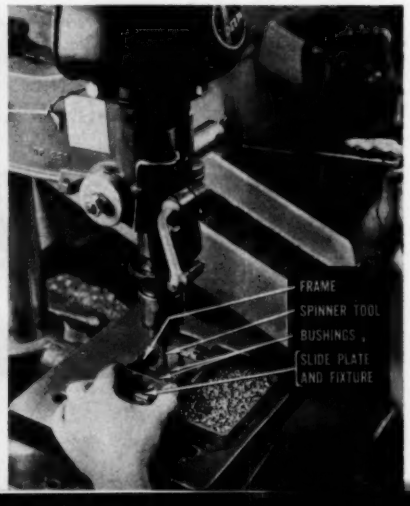
When such machining operations are performed, the entire machining cost will not be charged against the piece; even if these details were molded-in, there would still be a sizeable added charge for finishing.

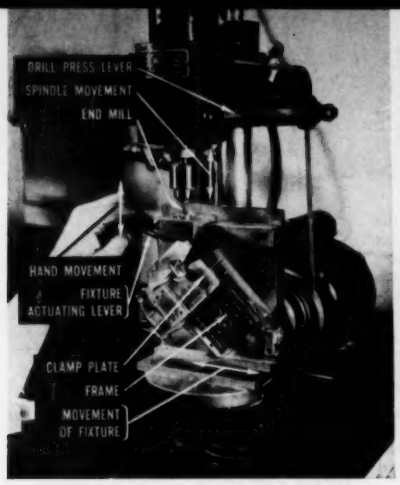
A perfect example of such a part is the frame for the newest hearing aid made by the Sonotone Corp.

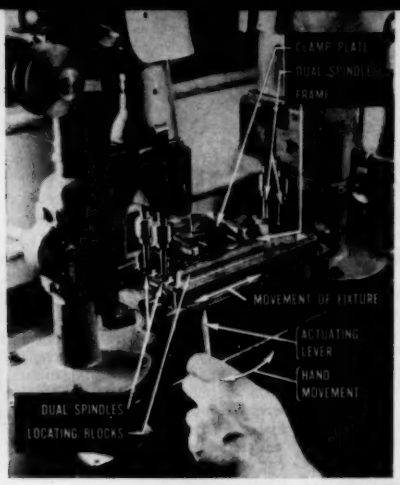
Below: Operation #8—Eyelet lug staking. Frame is positioned on fixture; eyelet lugs are located and staked to frame by staking head actuated by air cylinder



Operation #9—Bushing spinning. Bushings are located on slide plate, and frame is positioned over bushings. Spinning is completed on one bushing; then frame is moved right to left for spinning other bushing

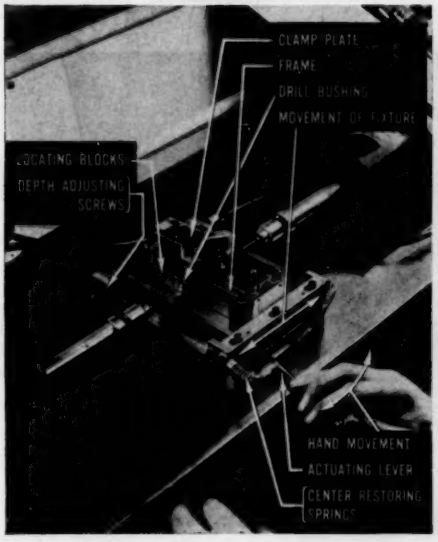






Left: Operations #4 & #5—Undercutting slots. Clamping fixture holds frame in position, locates it at proper level for cutting four recessed undercut slots in the ends of the frame. Fixture moves right to left to feed frame to dual cutters at each side of fixture. A similar fixture is used for two additional recessed undercut slots at one end of frame

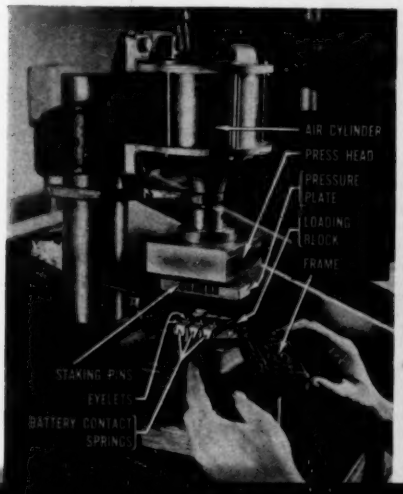
Operation #3—Making oblong opening. Clamp fixture holds frame, locates it for cutting opening in frame corner at required level. Hole is first drilled by actuating spindle which is held at this depth as fixture is moved by lever to make opening



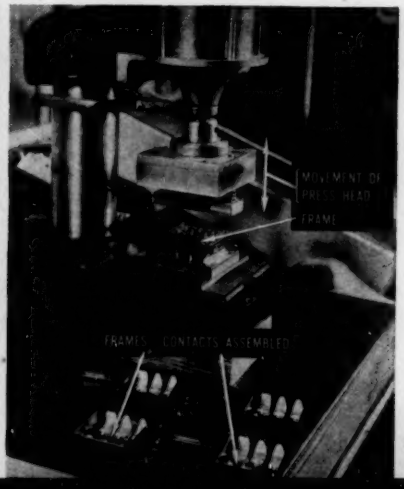
This frame or case is molded of Melmac melamine in a 2-cavity plunger mold by Watertown Mfg. Co., Watertown, Conn. As molded, it is a straight-draw job with no undercuts. Two preforms are preheated by high frequency and, because of this preheat, only a 2-min. cure is required. Many machining operations must be performed, however, in order to complete the frame. The accompanying photos illustrate the operations and the jigs, fixtures, machines, and methods used to complete fabrication of these frames.

Operation #7—Side hole drilling. Clamp fixture holds frame in position and locates it at proper level for drilling one hole in each side of frame. Fixture moves center, right, center; then center, left, center. Depth of each hole is controlled

Operation #10A—Loading contacts and eyelets. Twelve eyelets are positioned on loading block; six battery spring contacts are positioned over eyelets on block. Frame is positioned on eyelets and contacts



Below: Operation #10B—Staking contacts. After frame is positioned over contacts and eyelets, press head stakes eyelets in one shot, assembling contacts to frame



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Properties of Glass Fiber Laminates

by G. B. PARSONS†

THERE have been many data published on the strength properties of various glass fiber laminates. This material is widely scattered in publications, and some of the claims for strengths appeared to be a little optimistic. In an attempt to get some working values that could be used for design with an assurance that these values were not too optimistic, we have gathered together the data in Tables I and III to VII, which we have spot checked in our own laboratory to assure ourselves that our method of fabrication yielded allowables similar to those collected. Table II gives sources of the data.

Some of these strength data are also included in this paper in the form of curves for various physical properties with different filler compositions. Knowing the characteristics of these basic materials, the designer is able to combine these fillers in any manner which yields the desired properties of the finished article. Any text on anisotropic materials provides the designer with the required formulas for combining properties of the basic materials to arrive at the allowables for the composite laminate.

The wide range of strength properties encountered in the various fillers offers the designer a material that will have the required strengths where needed and will not have excess strengths with correspondingly excess weights in regions of low loading.

Included in these data on strength properties is Table VII showing the variation of tensile strengths with respect to slightly elevated temperature of some of the basic materials. With the entrance of glass fiber laminates into supersonic airframe design, much more work will be required on the development of resins which will yield less fall off of strength for elevated temperatures than those currently available.

Influence of Components

Filler—The filler is the major factor in determining strength proper-

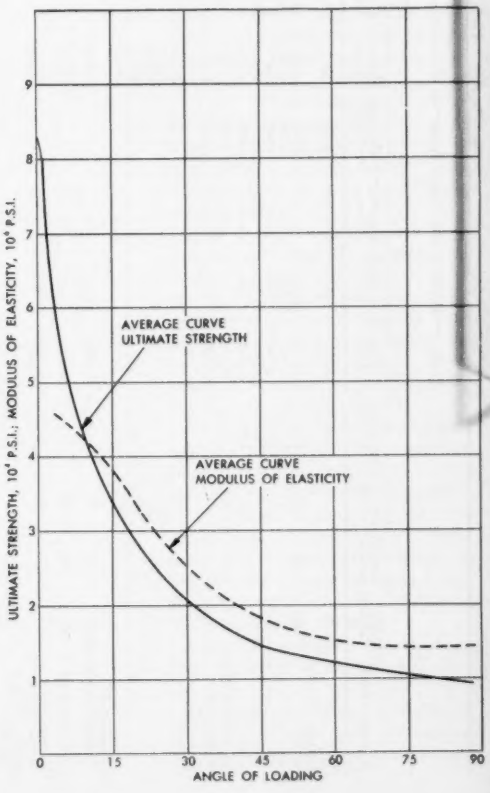

Fig. 1—Variation of ultimate strength and modulus of elasticity in tension of parallel-laminated Fiberglas 143 considering angle of loading

* Reg. U. S. Pat. Office.
† Chief, Molded Products, Fairchild Guided Missiles Div., Farmingdale, L.I., N.Y.

Table I—Strength and Elastic Properties of Fiberglas Laminates at Room Temperature

Laminate identity	Resin content	Specific gravity	Angle of applied stress	Tension: Proportional limit stress	Tension: Ultimate stress	Tension: 0.2% Offset stress	Tension: Modulus of elasticity	Compression: Proportional limit stress	Compression: Ultimate stress	Compression: 0.2% Offset stress	Compression: Modulus of elasticity	Flexure: Proportional limit stress	Flexure: Ultimate stress	Flexure: 0.2% Offset stress	Flexure: Modulus of elasticity	Hardness: Barcol	Hardness: Rockwell	Impact ft.-lb./in. of notch
	%			p.s.i.	p.s.i.	p.s.i.	10^6 p.s.i.	p.s.i.	p.s.i.	p.s.i.	10^6 p.s.i.	p.s.i.	p.s.i.	p.s.i.	10^6 p.s.i.			
112-114; alkyd styrene[2]	42.6	1.70	0°	8690	42,910	29,750	2.74	25,190	44,500	44,500	2.57	.....	.....	.....	.....	.....	.....	.....
			15°	8170	33,940	17,650	2.25	13,020	31,300	30,690	2.49	.....	.....	.....	.....	.....	.....	.....
			45°	3880	22,240	8,600	1.49	5280	18,870	11,150	1.57	.....	.....	.....	.....	.....	.....	.....
			75°	7460	29,940	15,010	1.90	13,110	26,400	26,200	2.69	.....	.....	.....	.....	.....	.....	.....
			90°	8520	41,200	27,040	2.57	20,820	32,350	32,350	2.67	.....	.....	.....	.....	.....	.....	.....
128; Selectron 5405[8]	42	1.75	0°	.....	30,600	.....	1.84	5500	6500	.....	1.07	.....	24,600	.....	1.56	.....	.....	.....
128; any resin[7]	.....	.....	0°	.....	38,000	.....	.....	.....	21,000	.....	.....	.....	45,000	.....	2.5	63	M111	21.3
128-114; Selectron 5003[3]	37.7	.....	0°	.....	.....	.....	.....	.....	78,000	.....	.....	.....	52,000	.....	3.4	.....	.....	25 (unnotched)
			15°	.....	.....	.....	.....	.....	28,000	.....	.....	.....	50,000	.....	3.15	.....	.....	27 "
			45°	.....	.....	.....	.....	.....	25,000	.....	.....	.....	40,500	.....	2.2	.....	.....	47 "
			75°	.....	.....	.....	.....	.....	26,000	.....	.....	.....	45,000	.....	3.1	.....	.....	28 "
			90°	.....	.....	.....	.....	.....	26,000	.....	.....	.....	49,000	.....	3.6	.....	.....	22 "
143; polyester[3]																		
Parallel laminated	33	1.75	0°	.....	77,000	.....	4.5	.....	50,000 (sp. gr. 1.85)	.....	.....	.....	115,000	.....	5.0	.....	.....	55 (sp. gr. 1.85)
Cross laminated	35	1.80	0°/90°	.....	55,000	.....	3.0	.....	50,000	.....	.....	.....	80,000	.....	3.5	.....	.....	30
143; any resin[7]																		
Parallel laminated	.....	.....	0°	.....	70,000	.....	.....	.....	45,000	.....	.....	.....	90,000	.....	5.0	.....	.....	.....
143; Conolon B stage[10]																		
Parallel laminated	24.2	1.69	0°	.....	116,000	.....	4.7	.....	15,840	.....	.....	.....	100,000	.....	4.6	.....	.....	.....
Cross laminated	24.2	1.69	0°	.....	49,000	.....	2.56	.....	35,700	.....	.....	.....	72,000	.....	.....	.....	.....	.....
143; diallyl phthalate 65/50[11]	54.1	1.56	0°	.....	90,800	.....	2.4	.....	61,200	.....	2.5	.....	.....	.....	.....	64	.....	.....
143-114; alkyd styrene[2]	31.3	1.85	0°	26,240	87,320	87,320	4.84	34,200	56,800	56,800	5.01	.....	.....	.....	.....	.....	.....	.....
			15°	8310	33,750	23,550	3.79	16,860	34,710	34,510	3.79	.....	.....	.....	.....	.....	.....	.....
			45°	3750	14,530	7470	1.72	5800	19,730	12,170	1.88	.....	.....	.....	.....	.....	.....	.....
			75°	2640	10,270	4740	1.47	8560	21,540	18,080	1.55	.....	.....	.....	.....	.....	.....	.....
			90°	2430	9880	4440	1.45	8350	20,950	19,830	1.56	.....	.....	.....	.....	.....	.....	.....
143-114; Selectron 5003[3]																		
Parallel laminated	34.7	.....	0°	.....	.....	.....	.....	.....	44,000	.....	.....	.....	10,600	.....	5.8	.....	.....	57 (unnotched)
			15°	.....	.....	.....	.....	.....	43,500	.....	.....	.....	88,000	.....	4.6	.....	.....	49 "
			45°	.....	.....	.....	.....	.....	25,000	.....	.....	.....	34,000	.....	1.8	.....	.....	20 "
			75°	.....	.....	.....	.....	.....	19,500	.....	.....	.....	20,000	.....	1.3	.....	.....	8 "
			90°	.....	.....	.....	.....	.....	19,000	.....	.....	.....	19,000	.....	1.2	.....	.....	8 "
Cross laminated	34.7	.....	0°	.....	.....	.....	.....	.....	33,500	.....	.....	.....	74,000	.....	3.8	.....	.....	30
			15°	.....	.....	.....	.....	.....	33,000	.....	.....	.....	63,000	.....	3.5	.....	.....	34 "
			45°	.....	.....	.....	.....	.....	26,000	.....	.....	.....	43,500	.....	2.2	.....	.....	50 "
			75°	.....	.....	.....	.....	.....	31,500	.....	.....	.....	63,000	.....	2.7	.....	.....	35 "
			90°	.....	.....	.....	.....	.....	31,500	.....	.....	.....	65,000	.....	2.9	.....	.....	27 "
OC64 (now 143); MR-1a[13]																		
Parallel laminated	.....	1.75	0°	54,500	69,600	.....	4.55	.....	31,400	.16	4.61	.....	55,900	.....	4.35	.....	.....	.....
			90°	1450	2600	.....	1.00	.....	12,000	.04	1.2	.....	6150	.....	1.06	.....	.....	.....
Cross laminated	.....	1.75	0°	.....	44,600	.....	2.08	.....	23,500	.045	2.80	.....	38,800	.....	2.13	.....	.....	.....
			15°	.....	20,100	.....	1.55	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			30°	.....	13,700	.....	1.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			45°	.....	10,500	.....	0.78	.....	11,000	.....	1.23	.....	16,200	.....	0.79	.....	.....	.....
162; Selectron 5003[8]	57	1.62	0°	.....	30,800	.....	1.9	12,800	20,300	.....	1.51	.....	34,000	.....	1.87	62	M116	32.9
162; Laminac 4201[9]	40	1.76	0°	.....	41,600	.....	2.45	.....	14,600	.....	1.65	.....	34,100	.....	2.30	62	.....	37
162; Laminac 4116[9]	40-45	1.68	0°	.....	40,700	.....	2.0	.....	16,000	.....	.....	.....	28,500	.....	.....	.....	.....	42
162; any resin[7]	.....	.....	0°	.....	30,000	.....	.....	.....	14,000	.....	.....	.....	32,000	.....	2.0	.....	.....	.....
181-114; Paraplex 43[1]	41.6	1.76	0°	.....	34,100	34,100	2.76	.....	32,300	32,300	3.32	47,300	55,400	55,400	2.65	.....	114	13.9

181-114; alkyd styrene[12]	36.7	1.85	0°	31,160	45,460	27,140	2.47	31,380	43,960	43,960	3.162	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			15°	9230	32,150	14,180	2.60	17,420	35,880	35,310	3.09	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			45°	4920	19,770	7780	1.69	6830	20,290	13,250	1.99	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			75°	7420	30,550	11,440	2.63	13,880	31,780	31,780	3.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
			90°	31,160	46,160	26,550	2.35	30,880	41,540	41,540	3.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
181; polyester[3]	38.0	1.75	0°	.....	40,000	.....	2.8	.....	37,000	.....	.....	.....	.....	.....	.....	61,000	.....	3.0	.....	.....	.....	.....	.....	25	.....
181-114; Stypol 16B[15]	39.0	.....	0°	.....	.....	.....	.....	.....	24,000	24,000	2.33	.....	.....	.....	.....	35,000	35,000	2.55	.....	.....	.....	.....	.....	.....	.....
181-113 or -114; any resin[6]	35-45	.....	0°	25,000	35,000	25,000	2.5	.....	25,000	24,000	2.5	25,000	45,000	40,000	2.5	.....	M95	7							
181-114; diallyl phthalate prepolymer[11]	.....	.....	.....	.....	41,000	37,900	2.9	.....	33,000	.....	.....	.....	32,600	47,900	44,350	3.1	.....	.....	.....	.....	.....	.....	.....	.....	.....
181; Laminae 4201[9]	40.8	1.87	0°	.....	43,600	43,600	2.7	.....	36,000	36,000	2.1	34,000	54,700	54,000	2.8	.....	M112	14.1							
181; Laminae 4203[9]	40.7	1.86	0°	.....	45,200	45,200	2.7	.....	34,200	34,200	2.3	36,000	59,000	57,000	3.0	.....	M113	15.2							
181; Laminae 4204[9]	38.2	1.84	0°	.....	44,300	44,300	2.7	.....	33,300	33,300	2.7	39,000	55,600	56,000	3.0	.....	M115	16.3							
181; Laminae 4129[9]	39.2	1.80	0°	.....	43,400	43,400	2.7	.....	28,300	28,300	2.3	40,000	57,500	57,500	3.2	.....	M114	15.4							
181; Laminae 4202[9]	38.8	1.87	0°	.....	46,700	46,700	2.7	.....	34,200	32,200	2.4	45,000	70,200	70,200	3.0	.....	M114	16.1							
181; Laminae 4115[9]	38.9	1.79	0°	.....	45,900	45,900	2.7	.....	38,301	38,300	2.7	45,000	17,400	67,400	3.2	.....	M114	16.2							
181-114; Selectron 5003[13]	39.3	.....	0°	.....	.....	.....	.....	.....	40,000	.....	.....	.....	57,000	.....	.....	3.1	.....	.....	.....	.....	.....	.....	.....	.....	.....
			15°	.....	.....	.....	.....	.....	38,000	.....	.....	.....	53,000	.....	.....	2.9	.....	.....	.....	.....	.....	.....	.....	.....	.....
			45°	.....	.....	.....	.....	.....	31,000	.....	.....	.....	45,000	.....	.....	2.3	.....	.....	.....	.....	.....	.....	.....	.....	.....
			75°	.....	.....	.....	.....	.....	35,000	.....	.....	.....	53,500	.....	.....	2.8	.....	.....	.....	.....	.....	.....	.....	.....	.....
			90°	.....	.....	.....	.....	.....	38,000	.....	.....	.....	57,000	.....	.....	3.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
Continuous fibers; polyester[3]	30	1.90	0°	.....	120,000	.....	5.0	.....	70,000	.....	.....	.....	150,000	.....	.....	6.0	.....	.....	70	.....	.....	.....	.....	.....	.....
Mat; polyester[2]	60	1.55	.....	.....	24,000	.....	1.5	.....	25,000	.....	.....	.....	32,000	.....	.....	1.7	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mat; any resin[7]	(USAF minimum values)			.....	22,000	.....	.....	.....	18,000	.....	.....	.....	30,000	.....	.....	1.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mat; phenolic binder; polyester[3]	57.7	1.50	0°	.....	17,380	.....	.....	.....	12,620	.....	.....	.....	27,300	.....	.....	1.39	.....	.....	21 (unnotched)	.....	.....	.....	.....	.....	.....
Mat; polyester binder; polyester[3]	(Estimated)		0°	.....	24,000	.....	.....	.....	25,000	.....	.....	.....	32,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mat; Laminae 4112[9]	65	.....	0°	.....	11,700	.....	.....	.....	.....	.....	.....	.....	20,500	.....	.....	1.16	.....	103	13.1	.....	.....	.....	.....	.....	.....
Mat; Laminae 4115[9]	65	.....	0°	.....	11,800	.....	.....	.....	.....	.....	.....	.....	20,800	.....	.....	1.17	.....	106	14.1	.....	.....	.....	.....	.....	.....
Mat; Laminae 4128[9]	65	.....	0°	.....	12,400	.....	.....	.....	.....	.....	.....	.....	23,900	.....	.....	1.17	.....	105	14.4	.....	.....	.....	.....	.....	.....
T-36-M Mat; Selectron 5003[13]	62	1.50	0°	.....	.....	.....	.....	.....	19,190	.....	.....	.....	35,160	.....	.....	1.67	.....	.....	18.9 (unnotched	.....	.....	.....	.....	.....	.....
M-503 Mat; polystyrene binder[12]																									
Paraplex 43	43	1.67	0°	4050	24,400	10,700	2.84	.....	24,000	.....	.....	.....	29,100	40,500	39,600	1.96	64	.....	.....	.....	.....	.....	.....	.....	.....
Selectron 5003	45	1.73	0°	.....	.....	.....	.....	.....	.....	.....	.....	.....	23,200	35,700	33,900	2.03	63	.....	.....	.....	.....	.....	.....	.....	.....
Vibrin 132	44	1.75	0°	.....	.....	.....	.....	.....	.....	.....	.....	.....	19,900	32,700	29,300	1.70	63	.....	.....	.....	.....	.....	.....	.....	.....
Laminac 4126	35	1.72	0°	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,400	37,800	30,000	1.94	63	.....	.....	.....	.....	.....	.....	.....	.....
Plaskon 920-11	41	1.76	0°	.....	.....	.....	.....	.....	.....	.....	.....	.....	19,700	32,900	32,000	1.87	64	.....	.....	.....	.....	.....	.....	.....	.....
Redux liquid	45	1.55	0°	.....	.....	.....	.....	.....	.....	.....	.....	.....	20,700	32,000	31,200	1.59	60	.....	.....	.....	.....	.....	.....	.....	.....

ties of the laminate. Compressive strength and interlaminar shear appear to be the only exceptions. Given a constant laminating resin, strength and modulus of elasticity are proportional to the density or percentage of fibers in laminate make-up and the percentage of these fibers effectively oriented in the direction of the applied load. Strength and elastic properties are highest when the load is applied parallel to the predominant fiber direction, lowest when loaded normal to the predominant fiber direction.

Continuing with the above case, where the laminating resin remains a constant, parallel laminated unidirectional[1] fabric is very strong in the warp direction, weak in the fill direction. Alternately cross-laminated[2] unidirectional fabric and bidirectional[3] fabric give essentially equal strengths in warp and fill directions. The ratio of warp to fill strength of unidirectional fabric laminates may be varied widely by assigning varying percentages of warp in the two major directions. In cross-laminated constructions, strengths at angles other than 0 and 90° with the warp (or fill) direction are always lower than the maximum value occurring at either 0 or 90°. These values vary systematically through each 90° of rotation, where the curve of values in each quadrant is the mirror image of the curves in the two adjacent quadrants.

Glass fiber mats (in which fiber directions are random) exhibit symmetrical strength and elastic properties in the plane of lamination. The same effect can be produced by systematically rotating the warp direction in successive plies of fabric laminate in what might be called "spiral lamination."

All glass fiber laminates are anisotropic, presenting definite cleavage planes parallel to the plane of lamination or concentric with the generated surfaces. Cross laminated (but not spirally laminated) fabric laminates are definitely orthotropic in strength and elastic properties, i.e., properties vary along the three mutually perpendicular axes.

Resin—Whereas the filler contributes primarily to strength and elas-

[1] In a unidirectional fabric, most of the fibers are aligned in the warp direction.
[2] Cross-laminating implies mutual 90° alignment of non-parallel warp threads.
[3] In a bidirectional fabric, warp and fill contain essentially equal numbers of fibers.

Table II—Sources of Data on Properties of Laminates[a]

No.	Source
1	Rohm & Haas Co.
2	Forest Products Laboratory Report 1893 and 1803A
3	Owens-Corning Fiberglas Corp.
5	Mellon Institute of Industrial Research
6	U.S.A.F. Specification #12049
7	U.S.A.F. Specification #12051
8	Pittsburgh Plate Glass Co.
9	American Cyanamid Co.
10	Narmco, Inc.
11	Shell Chemical Co.
12	Naval Air Material Center, Aero Materials Laboratory Report #AML NAM AE 440008, Part I
13	Naval Air Material Center, Aero Materials Laboratory Report #TED No. NAM 2409, Part II
14	N.A.C.A. Technical Note No. 1550, "Tensile and Compressive Properties of Laminated Plastics at High and Low Temperatures," by J. J. Lamb, I. Albrecht, and B. M. Axilrod (July 1948).

[a] Numbers in parentheses at end of line in Laminate Identity column of Tables I to VII refer to sources of data given in this table.

ty: properties, the resin contributes primarily to the following laminate properties: high and low temperature resistance; thermal shock; creep and flow; electrical properties; toughness and flexibility; weatherability; permeability and porosity; water resistance; chemical resistance; hardness; fire resistance; laminar shear strength; compressive strength and elasticity.

Advantages

For aircraft applications, where cost is not necessarily the prime consideration in selling the item, the following advantages can be cited for glass fiber laminates: 1) attainment of smoother aerodynamic surfaces; 2) greater flexibility in design; 3) a more favorable stiffness vs. weight and strength vs. weight ratio than metals, other than some aluminum and magnesium alloys; and 4) use of non-strategic material of construction. Frequently, cost savings can be demonstrated as well.

Surfaces—The aerodynamic smoothness of presently produced nose fairings and tail surfaces can be reproduced at moderate cost on all important surfaces, and to any desired lesser degree of smoothness on non-critical surfaces. Joints can be designed to permit flush mounted connectors.

Design Flexibility—The laminated construction permits tapered skin thicknesses and sandwiching of low density core materials, both very valuable devices for absorbing and gradually dissipating stress concentrations. Recent advances in the development of control surfaces have indicated that surfaces such as these can be produced much more economically than by fabricating thin metal constructions. It is possible to incorporate ribs, stringers, longerons, and structural reinforcements in the molding operation, eliminating riveting and other attaching methods and yielding components structurally superior to this latter method.

Strength-weight ratio—A favorable strength-weight ratio can be developed with a glass fiber laminated construction compared with the steel constructions currently used. If we arbitrarily define the specific strength of a material as its strength divided by specific gravity, the specific strengths of the materials involved appear roughly as shown in Table VIII.

Non-Strategic Materials—In times of national emergencies metals of all classes and stainless steels in particular are difficult to obtain. Even in normal times the supplies of nickel and chromium necessary for stainless manufacture may be restricted. These are non-replaceable minerals existing in the earth's crust in limited supplies. On the other hand, the basic raw materials of glass fiber laminates are common elements abundant in nature and permanently non-critical in supply. Thus there exists an urgent need for prototypes of all important critical defense items that can be made of non-critical substitute materials as insurance against the day of material shortages. In any industrial mobilization plan this item is of the utmost importance, and the time to develop these alternate materials is beforehand. The last war presented sufficient evidence of what happens when this is done under pressure.

Cost—Preliminary estimates indicate that a glass fiber propellant fuel tank could be fabricated for roughly 25% of the cost of the present stainless steel tanks. A saving of similar magnitude could probably be realized in a tapering, swept-back wing which would be difficult to fabricate from aluminum. Fuselage parts other than the tanks would also be relatively inexpensive. Low cost tooling would suffice for prototype parts; glass fiber laminates, concrete, and plaster are adaptable for forming dies. Adequate precision tooling would be necessary for a sizable production schedule, however.

Applications

In this discussion of applications of glass fiber laminates, two main

Table III—Panel Shear Properties of Fiberglas Laminates at Room Temperature

Laminate identity	Resin content	Specific gravity	Angle of applied stress	Panel shear: Proportional limit stress	Panel shear: Ultimate stress	Panel shear: 0.2% offset stress	Panel shear: Modulus of Elasticity
	%			p.s.i	p.s.i	p.s.i.	10^6 p.s.i.
112-114; alkyd styrene *(2)*	42.6	1.70	−45°	9960	20,680	20,680	1.43
			−30°	4630	14,910	10,290	1.17
			0°	1990	12,780	4200	.56
			+30°	5140	14,340	9620	1.09
			+45°	8410	24,070	24,070	1.33
143-114; alkyd styrene *(2)*	31.3	1.85	−45°	6510	6510	6510	2.32
			−30°	4540	7060	7060	1.61
			0°	2390	11,230	5090	.83
			+30°	4670	15,690	9760	.90
			+45°	4580	16,520	11,360	1.07
181-114; alkyd styrene *(2)*	36.7	1.85	+45°	17,360	22,320	22,580	1.62
			+30°	6180	15,540	11,410	1.23
			0°	2230	12,550	3530	.61
			−30°	5520	14,730	10,260	1.17
			−45°	14,680	22,970	22.970	1.69

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Barrett is taking steps to expand with America's defense needs, and to help fulfill civilian requirements as well. Besides increasing capacity at Barrett's Philadelphia and Ironton plants, plans are already under way for construction of new phthalic anhydride plants in Chicago and Philadelphia. The Philadelphia plant is expected to produce 36,000,000 pounds of phthalic anhydride annually. It's a huge order, but it's an order Barrett intends to fill.

* Reg. U. S. Pat. Off.

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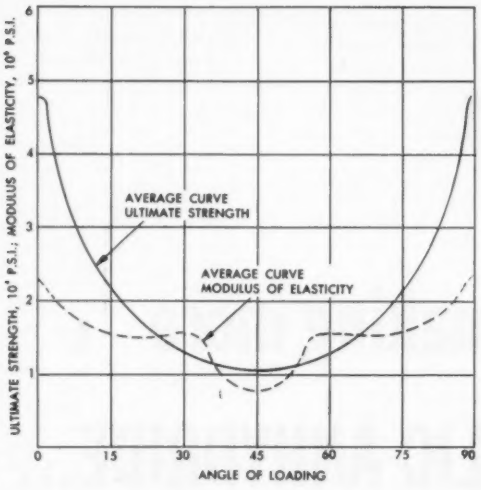
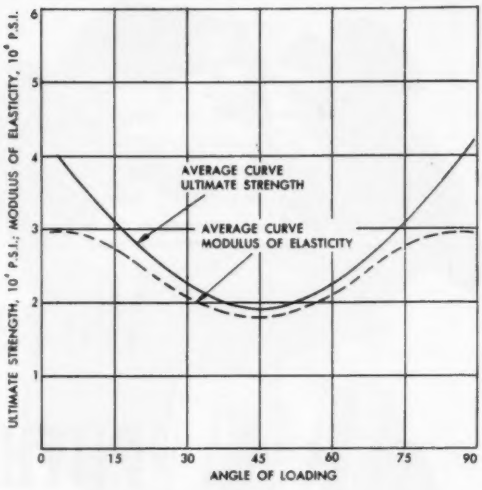




Variation in tension of cross-laminated Fiberglas 143 (Fig. 2, left) and parallel-laminated Fiberglas 181 (Fig. 3, right) laminates

categories are covered, namely, aircraft applications and non-aircraft applications.

Aircraft applications—Where weight is an important factor, it is felt that such things as wings, ducting, pressure bottles, radomes, fairings, wave guides, and similar items will eventually be made from glass fiber laminates or other molded products.

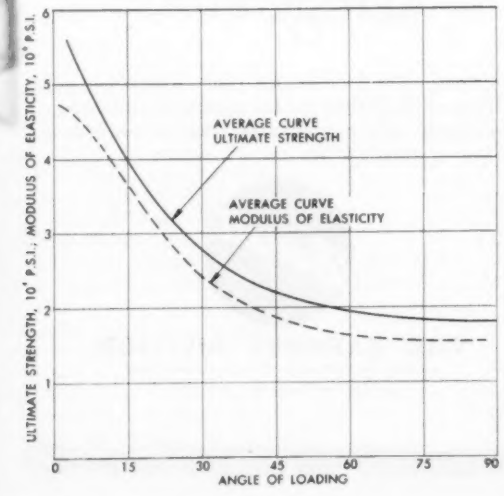
Supersonic ships present a num-

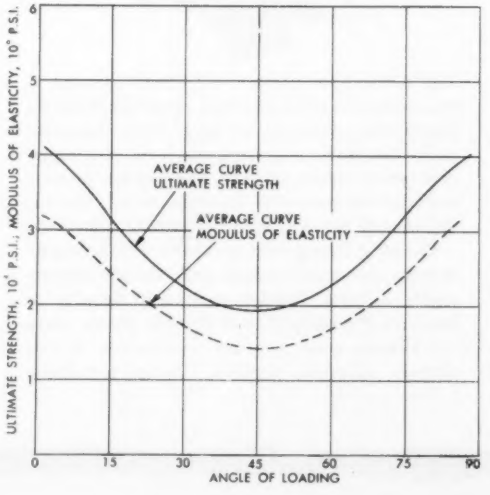
Table IV—Interlaminar Shear and Bearing Strength of Fiberglas 181-114 Alkyd-Styrene Laminates at Room Temperature (2)[a]

	Interlaminar shear	*Bearing*		
Angle of applied stress	*Ultimate stress*	*Stress at 4% elongation of hole diameter*	*Proportional limit stress*	*Ultimate stress*
	p.s.i.	*p.s.i.*	*p.s.i.*	*p.s.i.*
0°	4290	34,760	38,690	59,400
45°	4400	32,420	33,650	57,530
90°	4550	35,580	41,920	59,140

[a] Resin content of laminate 36.7%; specific gravity 1.85.

Variation in compression of parallel-laminated Fiberglas 143 laminate (Fig. 4, left), cross-laminated Fiberglas 143 laminate (Fig. 5)





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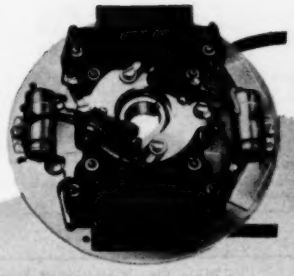

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Continental Can Co., Cambridge, Ohio, chooses PARAPLEX for its durable, design-printed, paper-base Conolite laminates. These laminates must combine beauty of pattern and color, chemical inertness, absence of odor and maximum resistance to heat and abrasion. PARAPLEX "P" Series resins fulfill all these requirements, and also adapt readily to the continuous laminating process used by Continental.

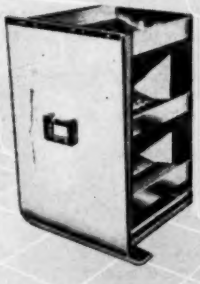

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Table V—Bearing Strength of Fiberglas Laminate, Room Temperature[a]

Laminate identity	*Angle of applied stress*	*Ultimate stress*
		p.s.i.
OC 64 (now 143); Marco MR-1a (*13*) parallel laminated (sp. gr. 1.75)	0°	27,800
	15°	33,200
	30°	31,300
	45°	29,400
	60°	21,700
	90°	15,900
Cross laminated (sp. gr. 1.75)	0°	20,700
	15°	31,000
	30°	28,500
	45°	27,200

[a] Test conditions: edge distance 0.6 in.; bearing hole diameter ¼ inch.

Table VI—Poisson's Ratio of Fiberglas Laminates at Room Temperature

Laminate identity	*Resin content*	*Specific gravity*	*Angle of applied load*	*Poisson's ratio*
	%			
112-114; alkyd styrene polyester, parallel laminated (*2*)	42.6	1.70	0°/90°	0.15
OC 64 (Now 143); Narmco MR-1a (*13*) parallel laminated	—	1.75	0°	0.16
" "	—	—	90°	0.04
cross laminated	—	1.75	0°/90°	0.045
143-114; alkyd styrene polyester, parallel laminated (*2*)	31.3	1.85	0°	0.25
" "	—	—	90°	0.08
181-114; alkyd styrene polyester, parallel laminated (*2*)	36.7	1.85	0°/90°	0.16

ber of fabrication problems not encountered in slower craft. Some of these problems can be solved by modification of present methods. Others can be solved advantageously by resorting to new techniques and new materials. Glass fiber laminates would be particularly

Table VII—Variation of Strength and Electrical Properties of Fiberglas Laminates With Temperature

Laminate identity	*Property*	*Load angle*	*—70° F.*	*77° F.*	*160° F.*	*200° F.*	*250° F.*	*350° F.*	*500° F.*
112; Plaskon 900; parallel laminated (*4*)	Flexure								
	Ultimate stress, p.s.i.	0°	70,500	53,200	—	33,000	—	—	—
	Modulus of elasticity, 10^6 p.s.i.	0°	3.15	2.88	—	2.48	—	—	—
	Compression								
	Ultimate stress, p.s.i.	0°	53,800	41,700	—	28,300	—	—	—
	Modulus of elasticity, 10^6 p.s.i.	0°	3.69	3.31	—	2.86	—	—	—
	Impact, ft.-lb./in. of notch	0°	46.1	31.5	—	26.6	—	—	—
	Tension								
	Offset stress, p.s.i.	0°	—	42,900	—	—	—	—	—
	Modulus of elasticity, 10^6 p.s.i.	0°	—	3.03	—	—	—	—	—
	Flexure								
	Ultimate stress, p.s.i.	45°	—	35,700	—	—	—	—	—
	Modulus of elasticity, 10^6 p.s.i.	45°	—	1.81	—	—	—	—	—
	Tension								
	Offset stress, p.s.i.	90°	44,400	33,302	—	26,400	—	—	—
	Modulus of elasticity, 10^6 p.s.i.	90°	3.24	2.53	—	2.08	—	—	—
	Flexure								
	Ultimate stress, p.s.i.	90°	—	46,000	—	—	—	—	—
	Modulus of elasticity, 10^6 p.s.i.	90°	—	2.84	—	—	—	—	—
	Impact, ft.-lb./in. of notch	90°	—	29.4	—	—	—	—	—
143; Conolon (*10*)	Flexure								
	Modulus of elasticity, 10^6 p.s.i.	0°	—	4.6	4.57	4.03	—	—	—
162; Laminac 4201 (*9*)	Flexure								
	Ultimate stress, p.s.i.	0°	—	28,800	13,400	—	—	—	—
	Modulus of elasticity, 10^6 p.s.i.	0°	—	2.05	1.25	—	—	—	—
181-114; Stypol 16B; parallel laminated (*5*)	Flexure								
	Ultimate stress, p.s.i.	0°	—	35,000	—	—	—	—	14,000
	Modulus of elasticity, 10^6 p.s.i.	0°	—	2.55	—	—	—	—	2.19
	Compression								
	Ultimate stress, p.s.i.	0°	—	24,000	—	—	—	—	9500
	Modulus of elasticity, 10^6 p.s.i.	0°	—	2.33	—	—	—	—	1.89
	Dielectric constant, 9360 mc.		—	3.96	—	—	—	—	4.18
	Loss tangent, 9360 mc.		—	0.0133	—	—	—	—	0.023
181-114; polyester (*2*) Mat; Selectron 5003 (*8*)	Compression								
	Ultimate stress, p.s.i.	0°	—	24,350	19,190	—	13,370	9580	—
	Tension, ultimate stress, p.s.i.	—	—	30,000	22,000	19,000	—	—	—
	Flexure, ultimate stress, p.s.i.	—	—	38,000	22,000	13,000	—	—	—
	Compression, ultimate stress, p.s.i.	—	—	18,500	8500	3900	—	—	—

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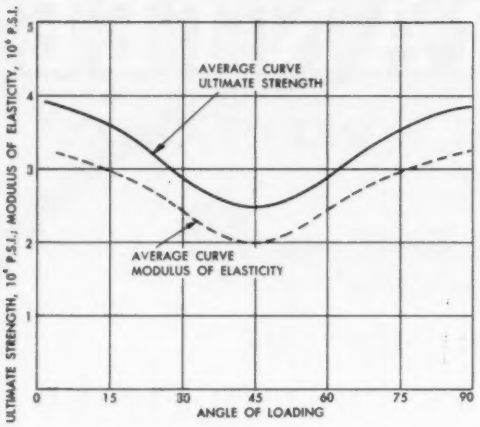


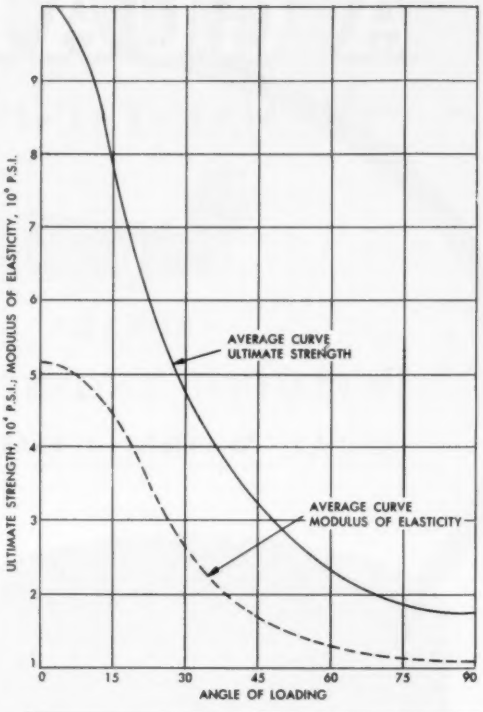
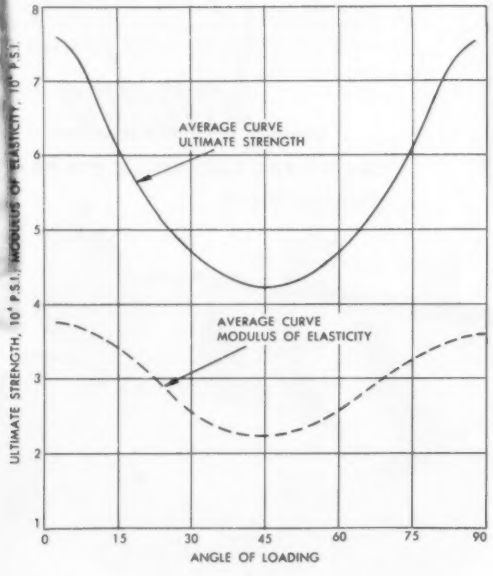
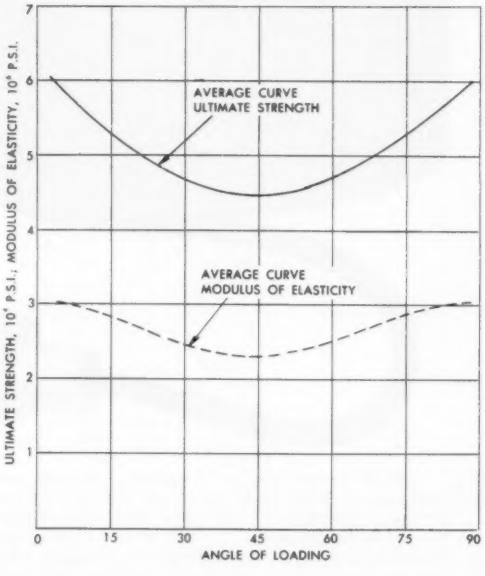


Fig. 6, (above)—Variation in compression of parallel-laminated Fiberglas 181 laminate. Fig. 7, (right)—Flexure variation of parallel-laminated Fiberglas 143 laminate. Variation in flexure of cross laminated Fiberglas 143 laminate (Fig. 8, below) and parallel laminated Fiberglas 181 laminate (Fig. 9, below, right). Variations in graphs considered with respect to angle of loading

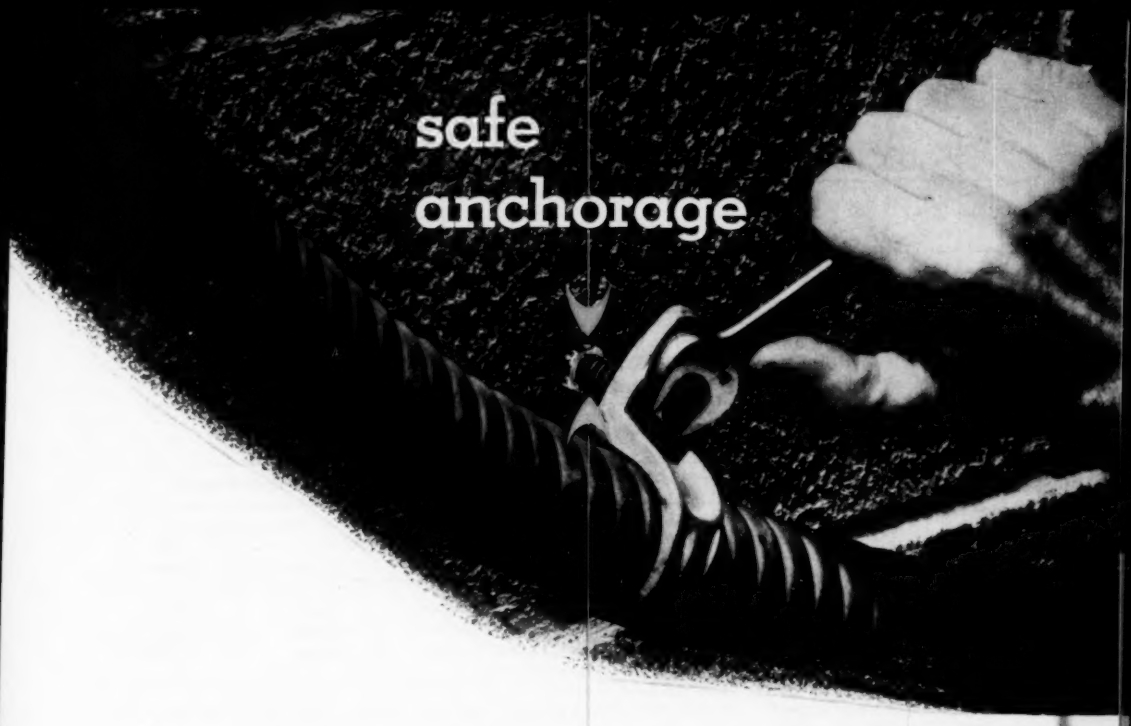




adaptable to the following parts:

Swept-back wings—A tapered section, tapered-skin-thickness wing with very smooth surfaces will probably be required. This could be fabricated from glass fabric, high temperature resin, and high-temperature-resistant core material. The resulting structure would be light, rigid, and aerodynamically smooth. Control surfaces would be similar construction.

Tail surfaces—Requirements for tail surfaces will probably be similar to those for wings, hence could be



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Tenite is also extruded for a variety of other uses — examples include dowel coating, furniture trim, and large pipe for the oil fields. For a long list of additional products, the versatile material is readily molded to exact dimensions. In all applications it offers exceptional durability and permanent freedom from corrosion.

For further information about the properties of Tenite, write Tennessee Eastman Company, Division of Eastman Kodak Company, Kingsport, Tennessee.

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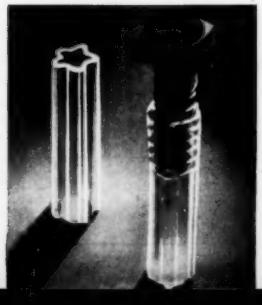
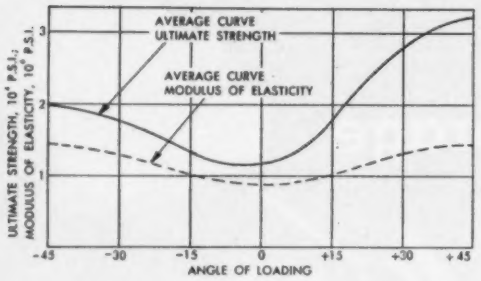
Scru-Tite anchors manufactured by Mastercraft Plastics Co., Inc., Jamaica, N. Y.



Information regarding Tenite is also obtainable through representatives located in Chicago, Cleveland, Dayton, Detroit, Leominster (Mass.), Los Angeles, New York, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, and Seattle; and elsewhere throughout the world from Eastman Kodak Company affiliates and distributors.



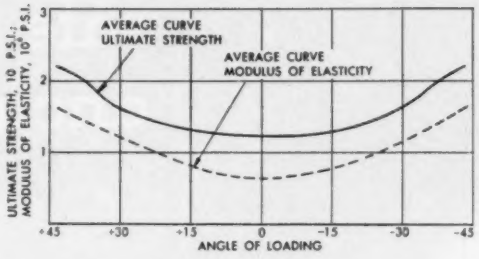


Fig. 10 (left)—Variation of ultimate strength and modulus of elasticity in panel shear of parallel-laminated Fiberglas 143 laminate considered with respect to angle of loading. Fig. 11 (right)—Variation in panel shear of parallel-laminated Fiberglas 181 laminate

met with analogous glass laminate design.

Radomes—Because of electrical requirements, radomes will have to be of glass fiber laminate or similar construction as they have been in the past.

Pressure bottles—Already considerable progress has been made toward producing a glass laminate air bottle; the greatest deterrent to date has been the absence of a good internal liner. Success of other molders in producing glass fiber laminated pipe capable of withstanding over 5000 p.s.i. and our own meager results make us confident in our ability to produce a pressure bottle capable of holding 3000 p.s.i. internal gas pressure. The largest single advantage of a glass fiber laminated pressure bottle is its safety feature. Corrosion, an ever present danger in steel bottles, is absent in the laminated bottles. Such a bottle is less likely to behave like a fragmentation bomb should it burst. A weight saving can also be realized provided the optimum strength of the glass fabric can be realized.

Table VIII—Comparison of Specific Strengths of Various Materials

Material	*Specific gravity*	*Specific strength* *Tension*	*Stiffness factor (EI)*[a]
		p.s.i.	
Glass fabric laminate	1.9	24,000	36,000
24ST wrought aluminum	2.7	24,000	44,000
Stainless steel	7.5	20,000	5800

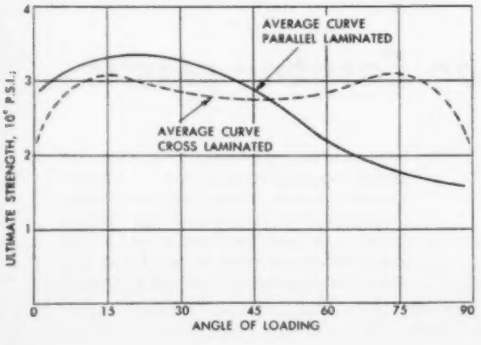
[a] Specific stiffness factor is determined from the formula: $EI = \frac{E\ b\ h^3}{12}$ where $b = 1$ and $h = \frac{1}{\text{Sp. Gr.}}$ (the specific thickness of the material).

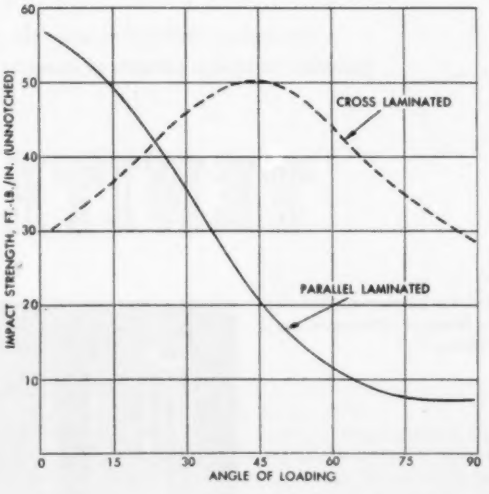
The stabilized production cost of a laminated bottle would depend entirely upon the degree of simplification possible through research in methods for wrapping the fabric laminations. A method similar to that used in winding cores of golf balls could spell a reasonable production cost, i.e., one not exceeding the cost of a forged steel bottle.

Propellant tanks—Propellant fuel tanks would involve a rather simple laminate development consisting of a cylinder with integrally molded or

(*Continued on p. 210*)

Fig. 12, (below)—Variation of ultimate strength in bearing of Fiberglas 143 laminate with respect to the angle of loading. Fig. 13, (right)—Variation of impact strength of Fiberglas 143 laminate with respect to angle of loading. Both cross-laminated and parallel-laminated forms are recorded in each graph





Evaluating Thickness by Beta Radiation

by JOHN DELMONTE*

EXAMINATION of material thickness with the aid of beta rays from certain radioactive materials has made possible a non-destructive test method applicable to the evaluation of sheets and films of plastics. The important principle entailed is that resistance to the passage of beta rays varies in accordance with the mass of material present per unit area of radiation path. This permits a direct quantitative determination of material thickness or what is even more important —uniformity of mass distribution in the radiation path.

Earlier methods of examining opaque plastics with a penetrating radiation such as X-ray have been successful in spotting sharp discontinuities in structure or foreign inclusions that have cast shadows on photographs made of the X-rays. In contrast, beta radiation is detected instantaneously by suitable instrumentation, the intensity of the radiation indicating the stopping power of the area traversed. It now becomes possible to scan large areas of ostensibly uniform sheets and films and detect material variations. The method is applicable not only to homogeneous materials, but also to laminated constructions, such as those using glass fibers or evaporated metal deposits on the surface of the plastic. It is also a fortunate coincidence that the usual thickness of most commercial plastics and rubbers are within the effective range of acceptable beta-emitters.

The singular quality of beta radiation for examining material thickness may be better understood by a brief review of the nature of the radiation from radioactive elements and their isotopes. The probable availability of sizeable quantities of low cost radioactive by-products produced by operation of nuclear chain reactors is of significant interest to members of the plastics industry, who will undoubtedly find ways of utilizing them after they learn about their characteristics.

The radiation emanating from radioactive elements has for many years been broadly classified as alpha, beta, and gamma radiation, the distinction being predicated upon the degree of penetrability into various substances.

Alpha radiation, comprised of helium nuclei, will travel only short distances in air or may be stopped by a few thicknesses of paper. It is one of the radiations frequently

(*Continued on p. 144*)

* Consulting Engineer, Glendale, Calif.

Table I—Types of Radiation From Nuclear Disintegration Processes[a]

Identity of radiation	*Origin*	*Characteristics*	*Examples of radioactive materials*
Alpha	${}_{A}X^{B} \rightarrow {}_{A-2}Y^{B-4} + {}_{2}He^{4} + Q$	High speed helium nuclei Limited penetration Deflected by magnetic field Energy release and range are characteristic of source	${}_{88}Ra^{226} \rightarrow {}_{86}Rn^{222} + {}_{2}He^{4} + Q$ (4.79 m.e.v.)
Beta	${}_{A}X^{B} \rightarrow {}_{A+1}Y^{B} + {}_{-1}e^{0} + Q$	High speed electrons released as neutrons change to protons Deflected by magnetic field Moderate penetration Continuous energy distribution explained by neutrino emission	${}_{19}K^{40} \rightarrow {}_{20}Ca^{40} + {}_{-1}e^{0} + Q$ (1.35 m.e.v.)
Gamma	${}_{A}{}^{*}X^{B} \rightarrow {}_{A}X^{B} + h\nu$	Very deep penetration, as nuclei change from one excited level to a normal level Gamma rays are homogeneous in energy, generally accompanying alpha or beta emission	${}_{82}{}^{*}Pb^{208} \rightarrow {}_{82}Pb^{208} + h\nu$ (2.62 m.e.v.)

[a] Code for symbols and abbreviations
X and Y = chemical elements
*X = element with excited nuclei
Q = energy release maintaining conservation of matter and energy. Appears in the kinetic energy possessed by the radiation
A = atomic number
B = number of neutrons plus protons
1 electron volt (e.v.) = 1.6×10^{-12} ergs
m.e.v. = million electron volts
$h\nu$ = energy of emitted radiation = Planck's constant × frequency

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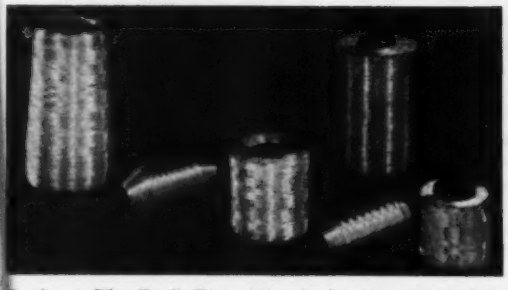

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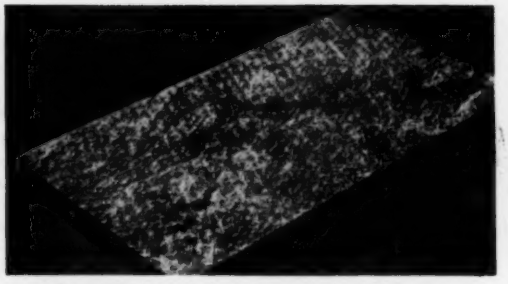

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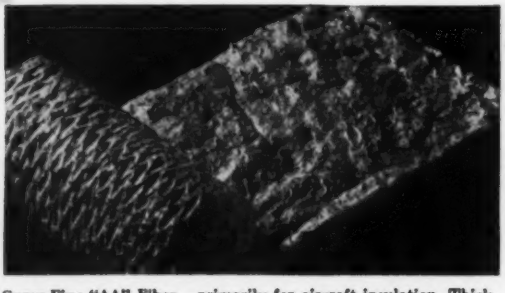

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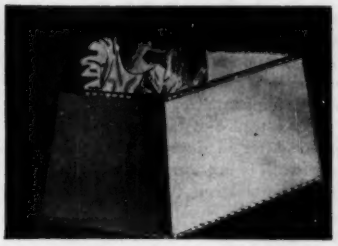

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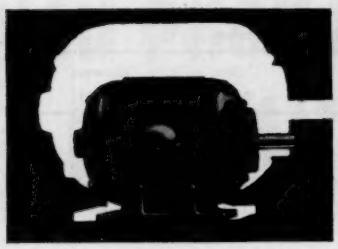

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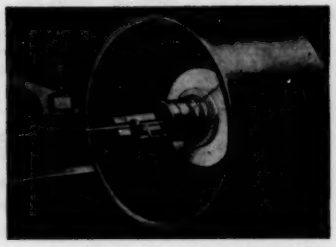

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Table II—Fission Products of Uranium

Isotope	*Yield (based on original uranium)*	*Half life*	*Beta energy*	*Gamma energy*
	%		*m. e. v.*	*m.e.v.*
Strontium 89	4.6	55 days	1.50	None
Strontium 90	5.3	25 years	0.61	None
Yttrium 91	5.4	57 days	1.53	None
Cesium 137	6.2	33 years	0.5 (95%)	None

present in the nuclear disintegration processes of heavier elements such as radium.

Beta radiation, on the other hand, comprises high speed electrons produced from changes in certain radioactive nuclei (Table I). These electrons are capable of penetrating much more deeply than the more massive helium nuclei of alpha radiation, though they will ultimately be stopped by the material they traverse. However, the examination of plastic material thickness is based upon the ability to detect these high speed electrons.

Gamma radiation is a form of electromagnetic radiation arising from transitions of the nuclei from one excited state to another. It is akin to X-rays, though of higher energy content. Gamma rays are very penetrating and capable of passing through large thicknesses of metal, and as might be expected, are not capable of discriminating small variations in mass or material thickness. In Table I are more clearly represented the salient features of alpha, beta, and gamma radiations, together with examples of typical reactions in which they appear.

Penetration of Beta Rays

In selecting a radioactive source that will provide the desired beta radiation (high speed electrons) for scanning a plastic sheet, the important considerations include availability, period of usefulness, purity of the beta radiation, and penetration ability.

Availability—While tables of radioactive materials reveal that beta-emission will occur in many radioactive disintegration processes, the radioactive isotopes produced from the fission of uranium will be the ones most readily available—and at lowest cost. The fission products of particular interest are listed in Table II.

These radioactive isotopes are pure beta emitters, a feature desirable for a beta radiation source to be used for measuring the thickness of the plastic. Strontium 90 has already been selected for one commercial instrument used as a thickness gage. Its decay process is as follows:

$_{38}Sr^{90} \rightarrow {}_{39}Y^{90} + {}_{-1}e^{0}$ (0.61 m.e.v.)
$_{39}Y^{90} \rightarrow {}_{40}Zr^{90} + {}_{-1}e^{0}$ (2.35 m.e.v.)
$_{40}Zr^{90}$ (stable)

Period of Usefulness—Following an exponential decay law the activity of a radioactive material decreases with the passage of time. For some materials the decay is rapid, the activity decreasing rapidly in a few minutes, while others may be useful for many thousands of years. The time for a radioactive material to lose 50% of its activity is called the half-life of this radioactive species. A long half-life is desirable—one reason that would prompt the choice of strontium 90 over strontium 89 as a beta-emitter, as an example.

Purity of Beta Emission—If the radioactive decay process is accompanied by a number of side reactions due to the formation and decay processes of other radioactive isotopes, interpretation of the activity of the material would be complicated. Even strontium 90 does not decay immediately to a stable element, though it does decay to an intermediate form of yttrium, which is also a pure beta emitter. Concomitantly they provide a good source for measurement purposes. The activity of the simple parent-daughter relationship supplied by this combination may be readily analyzed.

Energy of Beta Emitters—As pointed out in Table I, the energy of beta emission is distributed over a large range, which though at first was difficult to interpret in view of the quantum concepts of discrete units of energy, is now explained by the concept of neutrino emission. The formation of a proton from a neutron in a radioactive decay process is accompanied by the liberation of an electron and neutrino, which possess different degrees of energy. A neutrino is presumed to have the mass of an electron, though no electric charge. The values of energy reported for beta emitters are usually taken as the maximum value. Beta rays of lower energy content are generally absorbed by the lesser thicknesses while those of greater energy content traverse the greater thickness of material. An empirical relationship, first established by Feather in 1938, expresses the range for beta emitters as follows:

$$R = 0.542\,E_m - 0.133$$

for $E_m > 0.8$ m.e.v., where E_m = maximum energy of beta particles and R=range in g. per sq. cm. (irrespective of the material being observed).

While there are exceptions, in general the beta emitters displaying maximum energy for the beta particles possess shorter half-lives. This would indicate that while one may procure a beta emitter with greater penetration into thicker plastics, a shorter half-life would probably lessen its period of usefulness.

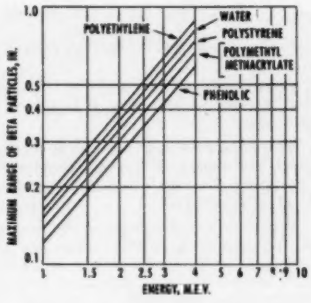


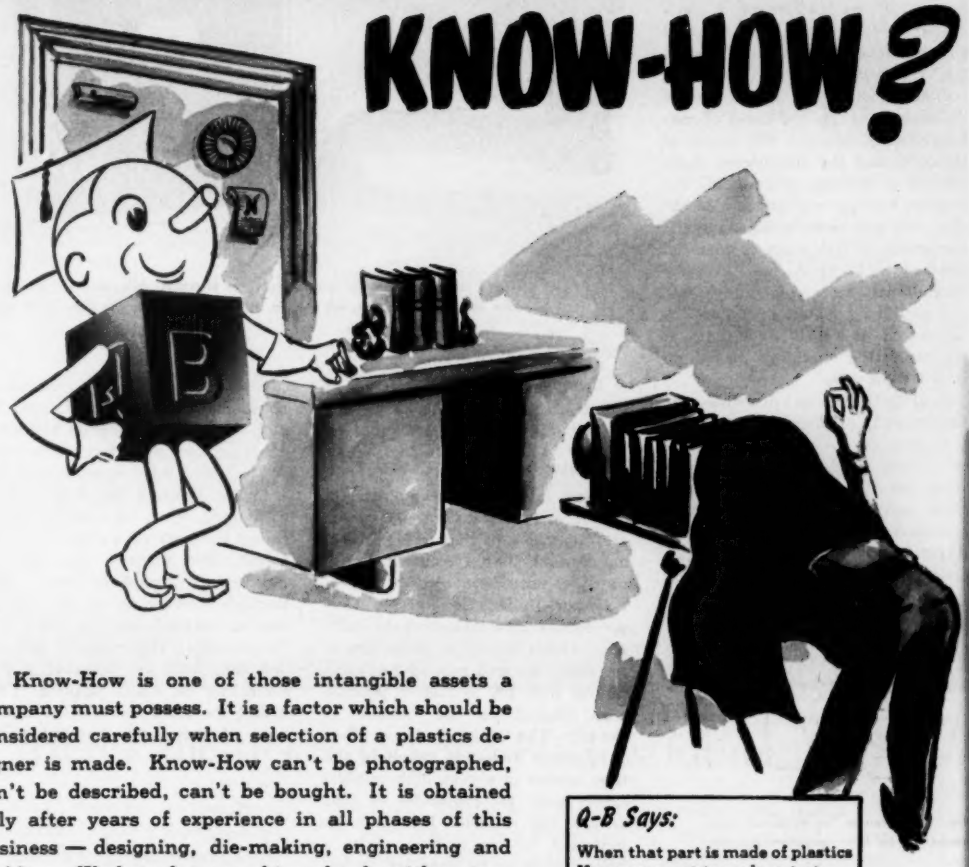
Fig. 1—Penetration ability of beta radiation through four plastics materials

Figure 1 shows the penetration ability of beta particles of various energy contents through various plastics.

Techniques

Schematically the adaptation of beta emitters to the measurement and control of sheets or coatings of plastics or rubber is quite simple as

HOW CAN YOU PHOTOGRAPH KNOW-HOW?



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depicted in Fig. 2. Automatic adjustments may be made in accordance with the measurements of the beta energy by the instrument. A calibrated beta source is positioned where measurements are desired and the instrument for measuring radiation intensity is located a short distance away. As the sheet of material passes between the source of emission and the instrument there will be a decrease of radiation intensity. Further variations in radiation intensity may be attributed to variations in the mass of material passing between. A representative commercial instrument developed for measuring material thickness is illustrated in Fig. 3. Beta particles traversing the sheet are picked up by a Geiger tube.

Radioactive decay processes are substantially unaffected by temperature or pressure, and are statistical in origin. Each discharge represents the disintegration of one nucleus, and the alpha particle, beta, or gamma radiation may travel in any direction from the nucleus, considered as the center of a sphere. Only

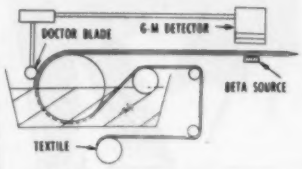
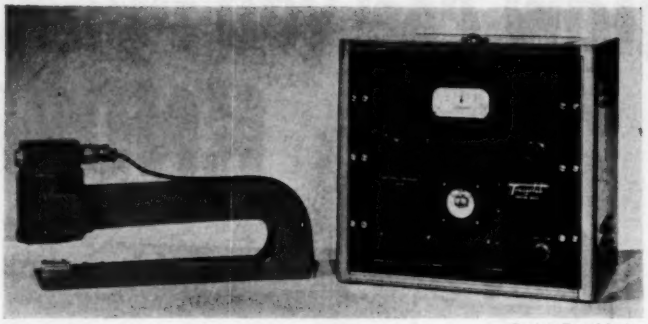


Fig. 2—Thickness is measured and controlled by beta radiation detector

those discharges moving in the particular direction of the device that will respond to the radiation will be recorded. When one realizes what a small portion of the surface of the sphere is subtended (Fig. 4), the likelihood of missing much of the radiation is recognized. In fact, it can be readily demonstrated by experiment that the response follows an inverse square law (i.e., measured activity $= K/R^2$ where K is a constant of proportionality for the instrument and R is the distance between the source of radioactivity and the instrument). Notwithstanding, when it is recognized that there are 6×10^{23} molecules per mole of substance and that, for example, strontium 90 with a half-life of 25 years has a specific activity of 5.86



Courtesy Tracerlab, Inc.

Fig. 3—Beta radiation gage for measuring sheet thickness. Beta particles traversing sheet, held in opening at left, are picked up by Geiger tube. Recorder is at right

$\times 10^{14}$ disintegrations per sec. per g. of material, the likelihood of achieving a statistical average is apparent.

Measuring Systems

There are various techniques for measuring the radioactivity which are applicable to thickness measuring devices. Two systems are currently in use:

Geiger-Muller Counter—A Geiger-Muller tube intercepts the radiation which ionizes gas molecules in the tube, the ions moving toward a central wire 200 to 1500 v. positive with respect to the outside of the tube. The total cumulative effect of a single radiation reaching the tube results in a very high amplification with an avalanche of ions toward the cathode. This may be indicated by an audible click, a lighted bulb, or be amplified to operate a recording device. A quenching circuit restores the tube in a small fraction of a second for receiving further radiation.

Scintillation Counter—More recent instruments utilize scintillation counters in observing radiation. The radiation is intercepted by a material such as stilbene, zinc sulfide, or anthracene, which will fluoresce. An adjacent photo-multiplier tube will amplify the weak visible light many times, and the resulting electronic signal is employed in operating indicating or recording devices.

In the thickness measuring gages using beta emitters as a source of radiation, initial calibrations must be conducted to evaluate environmental influences upon the measurements. Background "noise" in the equipment represents stray radiation due to cosmic rays, contaminated materials, etc., and must be kept to a minimum. When beta rays are measured, the effect of the mass of a Geiger tube window and the air mass (0.0012 g. per cc.) must be considered. Thus for a given application the beta rays originate from a radioactive material (e.g., salts of radioactive strontium 90), pass through intervening air, the thickness of material, and the walls of a Geiger tube. The mass of the air and tube wall are constant, and a correction is easily applied. This makes the chief variable the thickness of the sheet material being

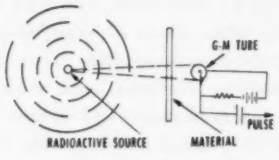


Fig. 4—Relationship between radioactive source, material, and Geiger tube

scanned. Suitable circuits may be devised to record this continuously or to adjust equipment, for example, to correct for variations in coating paper or fabric. The sensitivity of the measurement will depend upon the effectiveness with which background noise is minimized, and the proportion of the total energy observed that is attributable to beta particles traversing the sheet. Thus, a 1% change in material thickness may be easily detected if the cor-

(*Continued on p. 213*)

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U. S. PLASTICS PATENTS

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STABILIZER. R. N. Crozier and A. T. Marinaro (to Shawinigan). U.S. 2 555,320, June 5. Polyvinyl acetal resins stabilized with dicyandiamide-formaldehyde condensate.

CONTAINERS. D. H. Pollitt and P. G. Hawe (to Campbell Mfg.). U.S. 2,555,369, June 5. Machine for forming sealed plastic containers from sheet stock.

POLYMERS. P. D. Watson (to U. S.). U.S. 2,555,385, June 5. Metal polylactyllactate polymers.

POLYVINYL CHLORIDE. A. Hill and W. J. Burkholder (to Diamond Alkali). U.S. 2,555,407, June 5. Polymerization of vinyl chloride in aqueous hypochlorous acid-chlorine-sulfurous acid system.

CARBOXYETHYL CELLULOSE. W. M. Hutchinson (to Phillips Petroleum). U.S. 2,555 446, June 5. Method for producing a completely water soluble carboxyethyl cellulose.

SILICATE RESIN. A. Hirsch (to Diamond Alkali). U.S. 2,555,489, June 5. Resinous aryl silicate-aldehyde reaction product.

COPOLYMERS. F. R. Morehouse and W. J. Hornibrook (to Canadian Industries). U.S. 2,555,500, June 5. Linear copolymers of 4-vinylcyclohexene dioxide and a monoepoxide.

POLYPHENYL ALKANES. R. B. Thompson (to Universal Oil Products). U.S. 2,555,518, June 5. Photochemical condensation of phenylalkanes in the presence of an alkyl ketone.

COPOLYMERS. E. L. Kropa (to American Cyanamid). U.S. 2 555,551, June 5. Copolymers of p-isopropenyl toluene and unsaturated alkyd resins.

POLYSILANES. D. B. Hatcher (to Libbey-Owens-Ford). U.S. 2,555,589, June 5. Reacting ethylene with silicochloroform.

POLYMERS. R. C. Morris and J. L. Van Winkle (to Shell). U.S. 2,555,595, June 5. Esters of unsaturated acid branched chain hexadiene polymer adducts.

RESINS. R. B. Porter, Jr. (to American Cyanamid). U.S. 2,555,605, June 5. Condensing melamine, cresol, and formaldehyde, emulsifying with alkali caseinate, and adding aniline.

THERMO-REVERSIBLE GELS. G. D. Jones (to General Aniline). U.S. 2,555,646, June 5. Polymeric thermoreversible gels.

COPOLYMERS. J. R. Roach (to Gen-Mills). U.S. 2,555,834, June 5. Copolymers of fatty oils and polyallyl ethers.

STABILIZER. R. N. Crozier, E. Lavin, and A. T. Marinaro (to Shawinigan). U.S. 2,555,876, June 5. Polyvinyl acetal stabilized with melamine-formaldehyde.

RESIN. A. L. Rummelsburg (to Hercules Powder Co.). U.S. 2,555,-901, June 5. Reaction products of pine-wood resin and ethylene oxide.

SEALING. K. F. Spalding (to W. F. Stahl). U.S. 2,556,008, June 5. Heat sealing apparatus for sealing plastic material.

NON-STATIC POLYMERS. E. D. Serdynsky, J. S. Gowing, R. M. Wiley, and C. B. Havens (to Dow Chemical). U.S. 2,556 045, June 5. Vinylidene chloride polymer containing a carboxylic acid as an antistatic agent.

COPOLYMERS. G. W. Stanton and C. E. Lowry (to Dow Chemical). U.S. 2,556,048, June 5. Copolymers of vinylidene chloride and aliphatic epoxides.

POLYMERIZATION. J. G. Erickson (to American Cyanamid). U.S. 2,556,075, June 5. Polymerizing glycidyl compounds in the presence of iodine.

COATING. W. D. Niederhauser (to Rohm and Haas). U.S. 2,556,145, June 5. Coating composition consisting of chlorinated rubber, epoxidized oils.

POLYMER. J. P. West (to Universal Oil Products). U.S. 2 556,158, June 12. Condensation products of ethylene and a rubber.

PLASTIC WORKING. G. E. Henning (to Western Electric). U.S. 2,556,276, June 12. Apparatus for simultaneously advancing and working plastic material.

COPOLYMERS. R. W. Nye (to Har-

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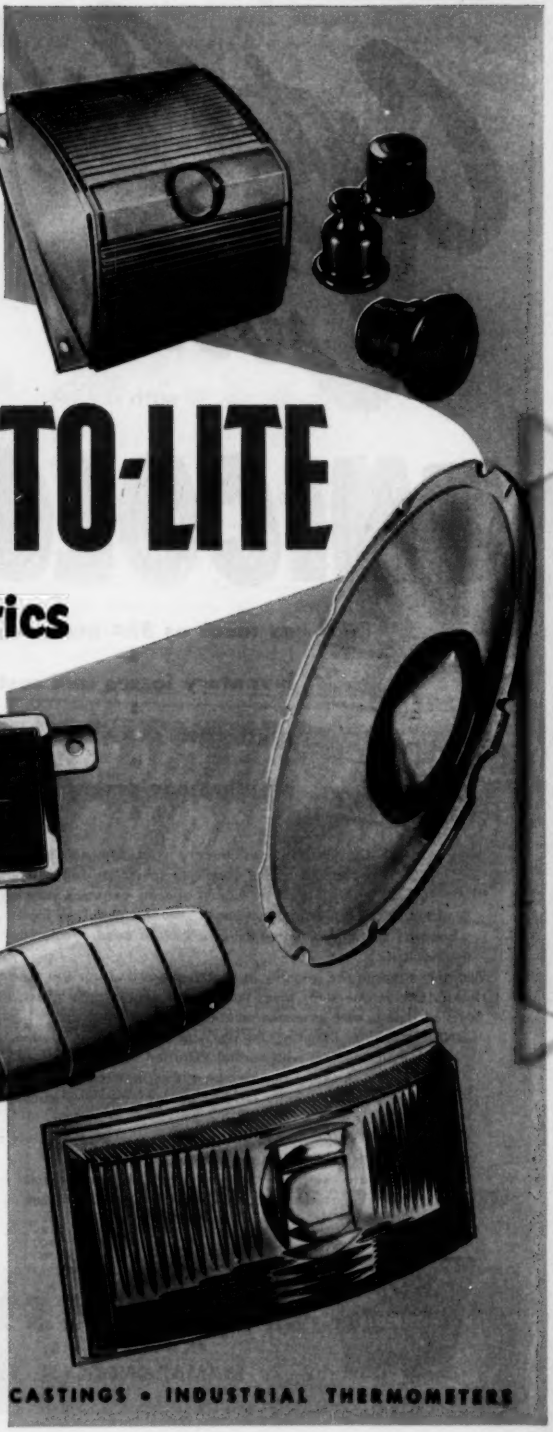

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vel). U.S. 2,556,336, June 12. Copolymerization of styrene with blown unsaturated oils.

STABILIZERS. J. K. Fincke (to Monsanto). U.S. 2,556,420, June 12. Pentavalent antimony compounds for the stabilization of polyvinyl chloride.

COPOLYMERS. D. T. Mowry and G. E. Ham (to Monsanto). U.S. 2,556,437, June 12. Copolymers of vinyl acetate and allyl carbanilates.

SEALING. K. F. Spalding (to W. F. Stahl). U. S. 2,556,452, June 12. Apparatus for sealing plastics.

COPOLYMER. G. L. Wesp (to Monsanto). U.S. 2,556,459, June 12. Method for copolymerizing styrene and alpha-methylstyrene.

FUSION WELDING. S. H. Lamport (to Golding Bros.). U.S. 2,556,476, June 12. Machine for seaming thermoplastics.

POLYSTYRENE. L. E. Wakeford and D. H. Hewitt (to Sherwin-Williams). U.S. 2,556,488, June 12. Polymerizing styrene in terpene solution.

PATTERNED SURFACES. F. M. Prestwich. U.S. 2,556,504, June 12. Manufacture of patterned articles from flat plastics.

SHEET CREASING. R. F. Taber (to Taber Instrument). U.S. 2,556,605, June 12. A plastic creasing machine.

WRINKLE COATING. W. A. Waldie (to New Wrinkle). U.S. 2,556,606, June 12. Oil-acid-modified alkyd resin wrinkle coating.

WELDING. R. S. Arkless. U.S. 2,556,609, June 12. Plastic extrusion welding device.

CEMENT. H. W. Schultz (to General Motors). U.S. 2,556,709, June 12. Cementing brake lining to brake shoes with a resin cement.

PLASTICIZER. A. Gislon and J. Quiquerez (to Compagnie Francaise de Raffinage). U.S. 2,556,721, June 12. Vinyl chloride resins plasticized with chlorinated hydrocarbons.

SULFUR DIOXIDE. W. W. Crouch and J. F. Howe (to Phillips Petroleum). U.S. 2,556,799, June 12. Heteropolymerization of sulfur dioxide, and an unsaturated organic compound in the presence of iron polyphosphate.

MOLDING. E. Menzel. U.S. 2,556,818, June 12. Automatically operating hy-

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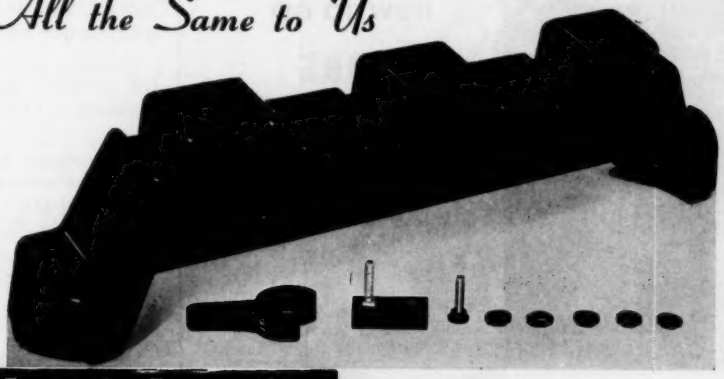

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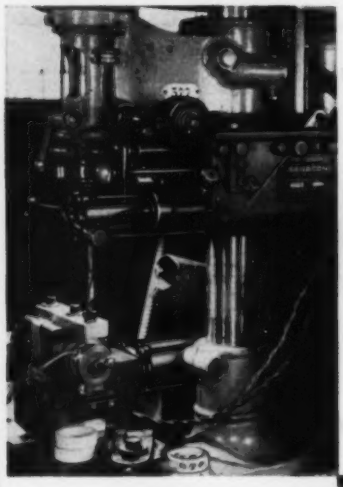

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POLYMERS. M. W. Swaney and F. W. Banes (to Standard Oil). U.S. 2,556,856, June 12. Reacting diolefin polymers with alkyl mercaptans.

POLYMERS. J. W. Hill (to Du Pont). U.S. 2,556,876, June 12. Polymeric azonitrile of 2,15-cetanedione azine.

RESINS. F. Lowey (to Solar Mfg.). U.S. 2,556,880, June 12. Heating chlorinated toluene in the presence of a Friedel-Crafts catalyst.

RESIN. A. Brookes and F. Lyth (to American Cyanamid). U.S. 2 556,898, June 12. Urea-formaldehyde sulphoxylate resin for high wet-strength paper.

COPOLYMERS. P. O. Tawney (to U. S. Rubber). U.S. 2,556,989-90, June 12. Copolymerizates of 2-propenyl alcohol with di-2-propenyl itaconates and also with styrene.

PLASTICIZERS. H. R. Gamrath, J. K. Craver, and W. E. Weesner (to Monsanto). U.S. 2,557,089-90-91, June 19. Polyvinyl chloride plasticized with monoalkyl diaryl phosphate esters or monoalkoxy diaryl phosphate esters.

TRIPOLYMER. J. D. Garber (to Standard Oil). U.S. 2,557,094, June 19. A tripolymer of isobutylene, p-chlorostyrene, and styrene.

RESINS. J. Nichols (to Interchemical). U. S. 2,557,136, June 19. Polymerized ester of an unsaturated dicarboxylic acid with the cyclic adduct of a conjugated diene, and an unsaturated alcohol.

COPOLYMERS. E. P. Irany, I. Skeist, and V. F. Maturi (to Celanese). U.S. 2 557,189, June 19. Copolymers of unsaturated esters.

POLYESTERS. M. M. Brubaker (to Du Pont). U.S. 2,557,256, June 19. Linear polymeric hydroxy keto esters.

RESIN. H. R. Dittmar and H. M. Cadot (to Du Pont). U. S. 2,557,266, June 19. Reaction product of an acrylic acid resin and a resin containing hydroxyl groups.

RESIN. J. C. Lehr, D. J. O'Flynn, and R. Y. Tompson (to Du Pont). U.S. 2,557,299, June 19. An alkali metal diglycollate-modified urea-formaldehyde condensate for paper treating.

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Battelle Memorial). U.S. 2,557,361, June 19. Ore flotation employing ion-exchange resin.

VINYL POLYMERS. A. K. Sanderson (to I. C. I.). U.S. 2,557,474, June 19. Heat stabilized vinyl polymers.

POLYMER. P. Adams (to American Cyanamid). U.S. 2,557,625, June 19. Polymeric tri - beta - hydroxyethyl cyanurate.

PLASTIC TREATING. A. Gerstenberg. U.S. 2,557,649, June 19. Machine designed for the kneading and conveying of plastics.

WATER REPELLENT. L. Q. Green (to Du Pont). U.S. 2,557,653, June 19. Alcohol dispersion of quaternary salts of methylol melamine fatty acid amide condensate stabilized with aromatic amine.

POLYMERS. E. L. Kropa (to American Cyanamid). U.S. 2,557,667, June 19. Polymerizable reaction products consisting of a cyanuric triester employed in conjunction with a polyhydric alcohol.

Encyclopedia Listing

It has been called to our attention that the "Personnel and Branch Offices" listing of Spaulding Fibre Co., Inc., as it appears on page 568 of the "1951 Modern Plastics Encyclopedia and Engineer's Handbook" is incomplete. The following complete listing is printed here with the suggestion that it be clipped out and pasted into the correct place in the Encyclopedia.

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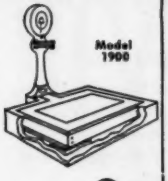

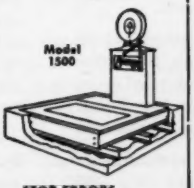

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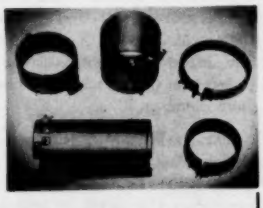

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General

FIRST BRITISH PLASTICS EXHIBITION AND CONVENTION. Brit. Plastics *24*, 223-265 (July 1951). A description and illustrations of the first British Plastics Exhibition and Convention are given.

PLASTIC EXTRUSIONS CUT COSTS IN RECENT APPLICATIONS. W. Schack. Materials & Methods *33*, 74-7 (June 1951). The advantages, available forms, fabricating, and properties of plastic extrusions are discussed.

Materials

VINYL PLASTICS FOR RIGID PARTS. C. E. Parks. Electrical Manuf. *48*, 113-16 (Aug. 1951). A new high molecular weight polyvinyl chloride resin is used in making unplasticized rigid plastic parts. Properties and applications are described.

EFFECT OF CIS AND TRANS OLEFINIC GROUPS ON THE PROPERTIES OF POLYURETHANS AND POLYESTERS. C. S. Marvel and C. H. Young. J. Am. Chem. Soc. *73*, 1066-9 (Mar. 1951). The cis and trans isomers of 2-butene-1, 4-diol are converted to polyurethans by reaction with hexamethylene diisocyanate, and to polyesters by reaction with sebacic acid. The capillary melting points of the cis polymers are lower than the trans isomers, but second order transition temperature, heat and entropy of fusion calculations, X-ray diffraction and infra-red patterns show little difference attributable to cis-trans isomerism.

RAT-REPELLENT FINDINGS. J. F. Welch. Modern Packaging *24*, 138-40 (May 1951). Evaluation studies were carried out in 1949-50 under controlled conditions to determine the resistance to rat attack of seven selected repellent compounds when they were applied in adhesive formulations. The test materials were incorporated in a wheat paste, ground rat-food combination in concentrations of 3 and 1% by weight and applied as a coating to the test panels and the test boxes for evaluation. These were exposed to wild Norway and roof rats held under near-normal conditions in ratteries located at the Denver Federal Center. Zinc dimethyldithiocarbamate-cyclohexylamine complex and tetramethyl thiuramdisulfide gave good protection at both the 3 and 1% levels in the tests. Sodium pentachlorophenate afforded fair protection at the 3% concentrations, but was less effective when used at the lower level. Adhesive coating containing copper sulfate, sucrose octa-acetate and sodium fluosilicate were more readily attacked by rats, although they gave varying degrees of protection in the several tests carried out. A germicidal product containing quaternary ammonium salts was found to be ineffective at these concentrations. When by error it was incorporated at a concentration of 15% (based on the active quaternary ammonium compounds) the results were more promising.

Molding and Fabricating

THREE DIMENSIONAL MOLDING. Brit. Plastics *24*, 32-6 (Feb. 1951). Techniques for molding badges and insignia with a three dimensional appearance are described.

PVC WELDING OPERATION. Brit. Plastics *24*, 44-5 (Feb. 1951). Techniques for welding polyvinyl chloride plastics are described. The design of parts and joints is also considered.

PVC FABRICATION IN SWITZERLAND. Brit. Plastics *24*, 120-1 (Apr. 1951). The fabrication of chemical equipment from polyvinyl chloride sheet, rods, and tubing is described.

Applications

IMPROVED CORROSION RESISTANT CEMENTS HAVE MANY APPLICATIONS. C. R. Simmons. Materials & Methods *33*, 81 (June 1951). The use of synthetic resins for the bonding ingredient in corrosion resistant cements is described.

STRUCTURAL ADHESIVES. W. E. Dirkes. Materials & Methods *34*, 80-3 (July 1951). The advantages of adhesives for structural applications, the physical types available, the limitations of adhesives now available, and new developments in the field are reviewed briefly.

COLLAPSIBLE DRUM. Modern Packaging *24*, 89 (May 1951). A 55-gallon container is made of fabric coated with synthetic rubber. When empty it is collapsed for return, reuse. It has high impact, chemical resistance.

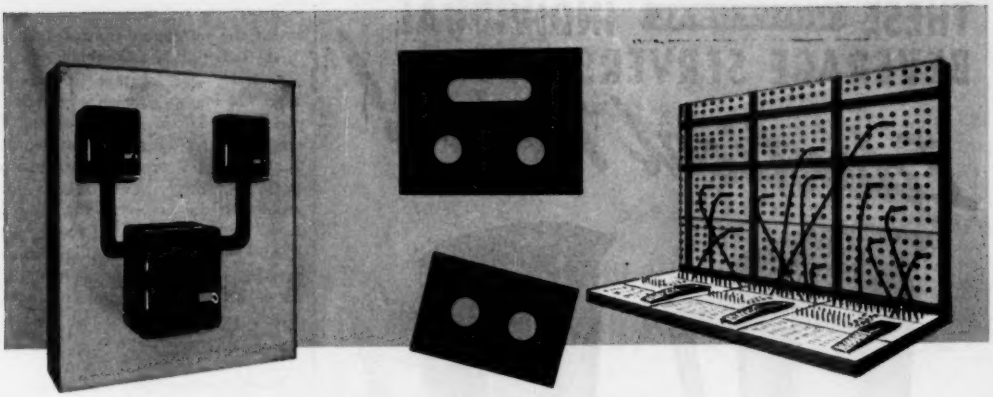
RULES AND SCALES. Plastics (London) *16*, 34-5 (Feb. 1951). Rules and scales made of acrylic, polyvinyl chloride, laminated wood, and phenolic plastics are described.

Properties

STRENGTH BEHAVIOUR OF ADHESIVE BONDS. H. P. Meissner and G. H. Baldauf. Trans. ASME *73*, 697-704 (July 1951). Practically all adhesive systems show an increase in strength with decreasing thickness of the adhesive layer. At least five different explanations for this "thickness-strength" rule have been proposed, based upon the following concepts: 1) Differences in physical structure; 2) molecular orientation of the adhesive; 3) theory of flaws; 4) reduction of plastic flow during test; 5) distribution of internal stresses. An investigation of these alternatives was made by testing butt joints between metal cylinders using eutectic solder, wax, and polystyrene as adhesives. Evidence indicating the correct explanation of the thickness-strength rule was obtained from a study of the effect on bond strength of bond geometry, from the location of bond failure, and from the relations between bond strength and bulk strength.

CREEP PROPERTIES OF LUCITE AND PLEXIGLAS FOR TENSION, COMPRESSION, BENDING, AND TORSION. J. Marin, Y. Pao, and G. Cuff. Trans. ASME *73*, 705-19 (July 1951). Creep-time relations in tension, compression, bending, and torsion were obtained for Lucite and Plexiglas. For each type of stress the influence of the stress and time on the creep deformations and creep rates were determined. Various interpretations of the test data are

* Reg. U. S. Pat. Office.



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made. There is a linear relation between the minimum constant creep rates and the stress when represented on a log-log plot. The creep deformations in tension and compression are expressed in terms of the stress and the time by an equation which considers the initial creep strain. A theory is developed for predicting the creep deflection and creep rate in bending, using the creep constants in tension and compression. Good agreement is found between the experimental and theoretical results.

Testing

ELASTICITY OF SOFT POLYMERS. C. A. Dahlquist, J. O. Hendricks, and N. W. Taylor. Ind. Eng. Chem. *43*, 1404-10 (June 1951). A constant-stress method of elongation was developed to measure precisely the elastic properties of polymers and plasticized rubber compounds which are too soft to test on conventional stress-strain machines. Constant stress is achieved by employing a tension weight in the shape of a hyperboloid. As the film stretches, the weight is lowered into a liquid, and buoyancy reduces the load in proportion to the decrease in cross-sectional area of the test specimen. This is of importance in the measurement of the elastic properties of soft polymers because their elastic behavior is highly time-dependent. The method is particularly useful for characterizing unvulcanized polymers and for evaluating plasticizers in uncured compounds. Data are presented on such materials as polyvinyl acetate, polymethyl acrylate, polyethyl acrylate, natural rubber, GR-S, Vistanex, Hycar PA, Hycar OR 25, and plasticized Hycar OR 25.

Chemistry

KINETICS OF CONTINUOUS REACTION PROCESSES: APPLICATION TO POLYMERIZATION. K. G. Denbigh. J. Applied Chem. *1*, 227-36 (May 1951). The general principles of the kinetics of reaction as carried out in the two main types of continuous process are discussed. Comparison is made with the corresponding batch system with regard to the necessary volume of reaction space. It is shown that a correct choice of the type of process can sometimes be used to increase the yield of a reaction. The application of these principles to polymerization is described.

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This Figure Prepared with Vinylite Brand Plastics.

NEW MACHINERY AND EQUIPMENT

TAPPING ATTACHMENT—Skilled or unskilled operators can perform perfect tapping with little or no danger of damaged threads with a new precision Lead Screw Tapping Attachment manufactured by Automatic Methods, Inc., 42 Walnut St., Newark 1, N. J. The fixture consists of a support arm and its clamp, screw, and washers; a lead screw; a split nut and its mounting screws and washers; a lock assembly; and a Jacobs Rubberflex collet and nut. The split nut and lead screw are interchangeable for different threads so that a variety of precision threads can be produced. The assembly is provided as a support arm attachment to any standard drill press.

By driving the tap with the lead screw, virtually perfect threads are said to be produced. Utilizing the newest type of collet, taps of all standard sizes up to ¼ in. can be used without changing the collet. When used with any standard reversing-type tapping head in a drill press, production is said to be substantially increased. The attachment is made to fit 14- to 15-in. drill presses having a column of 2¾ in. diameter.

METAL DETECTORS—New metal detection equipment, designated the Guardsman Series and designed for speedier location of metallic particles contaminating non-metallic products, has been introduced by Engineering Products Dept., RCA Victor Div., Radio Corp. of America, Front & Cooper Sts., Camden, N. J. The detectors, to be marketed by Eriez Mfg. Co., Erie, Pa., will indicate the presence of minute magnetic or non-magnetic particles regardless of their depth in the material being tested. Products pass the inspection unit at rates of from 10 to 1000 ft. per minute. Any type of signalling device can be used in conjunction with the instrument.

Guardsman detectors consist of two units: the control, which is the same for all applications, and which measures 8¼ in. high, 6¾ in. wide, and 10 in. deep; and the inspection head, provided in four different styles. Two box-type heads have rectangular apertures and are for items that can be carried on a conveyor belt during processing; and the others have round apertures for items that pass through the small head in a non-metallic tube or trough. All of the models operate on 115 v., 50/60 cy., and they draw only 70 watts.

TWO-STATION, TWO-COLOR SPRAY PAINTING—Decorative paint finishes can be mechanically and automatically applied to plastics products, metal stampings, and die castings by a new two-station, two-color spray painting machine. The device, made

by Sepanski & Associates, 414 Henry Ave., S.E., Grand Rapids 6, Mich., will satisfactorily handle jobs where one color is easy to apply and the other involves intricate angles, depressions, or raised portions requiring uniform coverage.

Work to be painted is pressed against the spray mask which is semi-permanently installed in the spray opening. One operator can handle the two colors in sequence.

Within the machine, pneumatic power moves two automatic spray guns parallel to the surface being painted so that an even coating is applied. The guns, adjustable for any desired spray density, can be set from any angle from 0 through about 30° in any direction, and can be regulated to alter automatically the angle of application during transit to assure uniform paint distribution to all surfaces.

Length of stroke and speed can also be controlled to provide uniform coating in both directions or heavier coverage in one direction than in the other. Timers guarantee full-cycle coverage in any given period.

Sizes available provide spray areas for each station that are 6-in. wide by 12-, 18-, or 24-in. long. Custom-built units are available for greater lengths and widths.

COMPRESSION PRESS—A low-cost hydraulic unit for general purpose compression molding of plastics has been developed by Oilpower Engineering Co., 1067 Davis Terrace, Schenectady 3, N.Y. The new model has a 50-ton rating at continuous duty, platen area of 25 by 20 in., a 10½ in. stroke, maximum daylight of 20 in., and a bolster area without overhang of 18 by 20 inches.

The equipment is powered by a 10-hp. electric motor which drives a piston-type hydraulic pump operating the ram at a speed of 55 in. per minute. The down-moving, double-acting ram is controlled by a fast-acting lever-type four-way valve. The frame is of four-rod construction.

CARBIDE-TIPPED ROUTER BIT—Increased service life is an important merit claimed for the Cyclo-Router carbide-tipped bit for wood and plastic, introduced by New England Carbide Tool Co., Inc., Auburn & Brookline Sts., Cambridge 39, Mass. The bit is made in ¼-, ⅜-, and ½-in. diameters for portable electric routers with standard ¼-in. shanks. These same sizes and larger diameters are available for production routers with standard ½-in. shanks. The bits are said to be particularly effective when used to cut glued or laminated sections of wood and plastics.

CYLINDER—Improved design and construction features are incorporated in a low-pressure cylinder,

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Model H-200

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2-oz. capacity. Van Dorn's engineering experience has scored again with this leader among all injection presses of its class. Its ultra-modern design insures faster operating cycles—up to 6 per minute. Push button controls are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.

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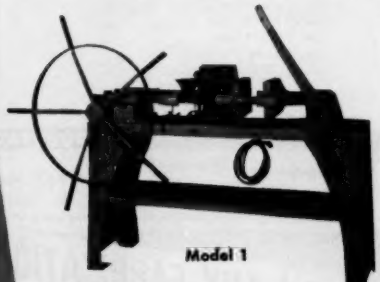
3. **Use less expensive molds**
4. **Easily set up by one man in a few minutes**

These presses mold practically all thermoplastics including nylon . . . Look over the Van Dorn presses and plastic equipment shown—*then write for detailed Bulletins on individual machines.*



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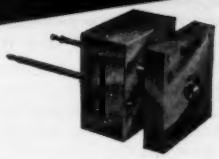

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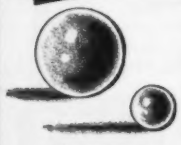

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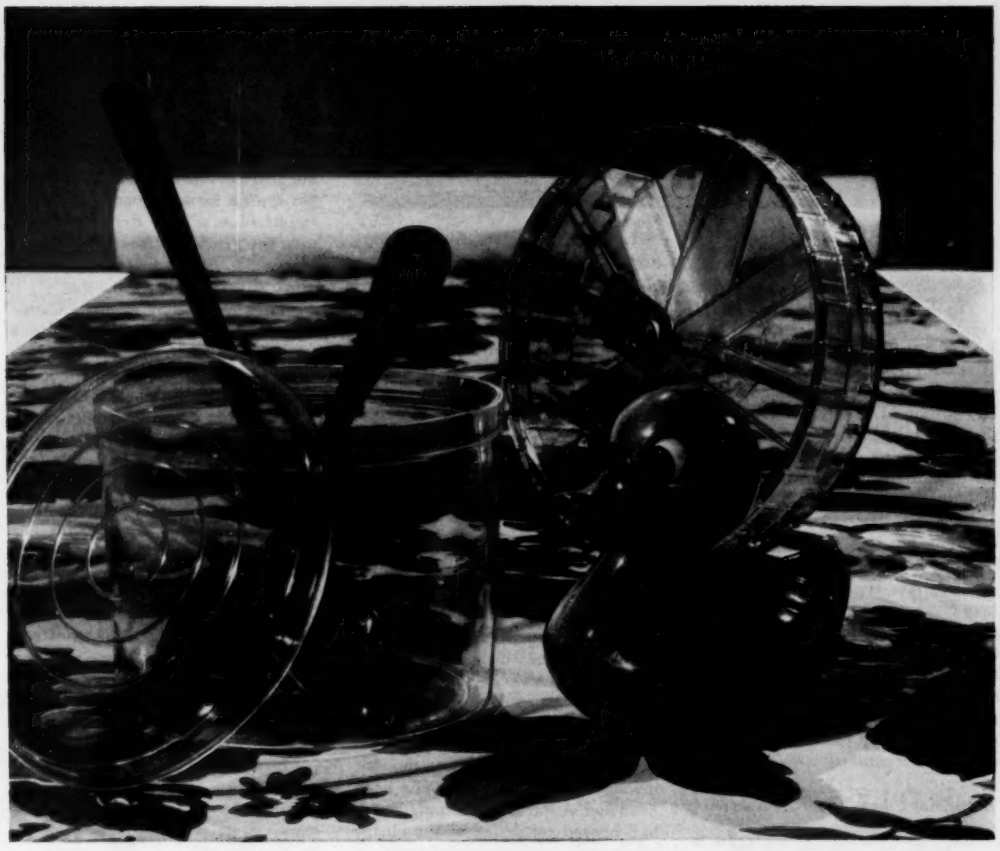
model 4M, one of the LP series manufactured by Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill. Highlights of LP cylinders, which operate by air, oil, or water, include: a cork floater ring which facilitates cushion alignment with the head and insures a seal during cushioning; spring-backed chevron rod packings, self-adjusting for consistently correct impression; and a flange design permitting removal of the front head without disturbing the mounting. LP cylinders are made for use at up to 110 p.s.i., and for higher pressures with minor modifications.

RAPID WOOD-PLASTIC-METAL WELDER—Bonding of plastic, wood, or their combination with metal parts is said to be accomplished faster through use of a new vacuum tube self-excited wood welder produced by Wood Welder Mfg. Co., 2758 Whittier Blvd., Los Angeles 23, Calif. Operating on a set frequency of 27.12 mc., the welder has a penetration range of from ⅛ to 2 in., and provides tight bonding in a matter of seconds for material which would ordinarily require several hours.

The welding gun works off power supplied by a small generator. A three-position power selector switch determines energy to be supplied in proportion to depth of material to be bonded. Instant setting timer provides for automatic or semi-automatic operation.

FIBER BENDING PRESS—Two hydraulic presses, designed for bending vulcanized fiber for the edges of luggage and sample cases, have been introduced by Studebaker Machine Co., 1221 S. 9th Ave., Maywood, Ill. One model, a self-contained, foot-operated unit, will handle pieces up to 36 in. long, while dies of the motorized press, also self-contained, can bend pieces up to 60 in. long.

Principal assets of the presses are said to be faster production and the elimination of cracks in bends. These merits are made possible by steam vents in the lower V-die which steam and heat the fiber on the outside. The corresponding die is electrically heated, and the resultant product is a uniform, 90°, crack-free bend. The presses are also used for forming molded resin products and for laminated glass fiber products.



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BOOKS AND BOOKLETS

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"Industrial Solvents" by I. Mellan

Published in 1950 by Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. 758 pages. Price $12.00

Over 380 solvents, grouped to conform with the needs of all industries, are considered in detail in this second edition of what is claimed to be the only reference work of its kind. In revising the original publication, up-to-date material has been added, including a chapter on safe handling of toxic and flammable solvents. On the other hand, information on plasticizers, to be covered in a separate volume, has been eliminated. The text presents physical data and applications in many fields. Graphs and tables are provided to afford the reader a rapid means of obtaining comparative information on such physical properties as evaporation ratio, solubility, phase equilibrium, and dilution ratio.

"Artificial Fibers" by R. Moncrieff

Published in 1951 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 313 pages. Price $4.50

Regenerated cellulosic and alginic fibers, regenerated protein fibers, and synthetic fibers are the three general groups discussed in this volume on "man-made" fibers. The book gives the historical and developmental background of these fibers. Also discussed are the important manufacturing processes, chemical and physical properties, and uses.

"Chemical Facts and Figures," compiled by Marjorie V. Campbell and M. F. Crass, Jr.

Published in 1951 by Manufacturing Chemists' Association, Inc., 246 Woodward Bldg., Washington 5, D. C. 419 pages. Price $3.00

Statistics relating to U. S. production, sales, imports, exports, and prices of chemicals and allied products for the period 1946 through 1949 (as well as partial data on the first half of 1950) are included in this third edition. (Previous editions covered 1929-1939 and 1940-1945.) Some 500 new chemicals are considered. Among other highlights are financial records of 100 leading chemical process firms on an annual basis for the years 1939 to 1949 and a special section on employment and wages. In addition to U. S. data, the book contains available Canadian statistics, including a new section on minerals.

"Packaging: Teamwork Makes the Successful Package"

Published in 1951 by Lippincott & Margulies, Inc., 500 Fifth Ave., New York 18, N.Y. 36 pages. Available free to members of the profession.

On the premise that a package in the modern market must do a job for several departments, a pictorial presentation of case histories has been assembled to show how new or revised packages evolve from collective thinking. A "before and after" approach is employed in each case with captions setting forth how the demands of various departments have been met. A Package Planning Board is proposed consisting of the client; advertising agency; merchandising, designing, and package engineering divisions; and the packaging account executive.

Thermometers—Wide range and flexibility of application are stressed in this industrial instrument bulletin devoted to standard dial-type indicating and recording thermometers. Among the products described are recording gages and transformer and freezer thermometers. Photographs and sketches are presented to illustrate methods of installation and application. Charts of ranges are also provided. *Instrument & Gage Div., The Electric Auto-Lite Co., Toledo 1, Ohio.*

Plasticizer for vinyls—Useful data on the properties and performance of Paraplex G-60, a polymeric resin which both plasticizes and stabilizes vinyl films, are offered in this new four-page folder. Contents of the folder outline the resin's compatibility with and solubility in a wide variety of materials; describe uses of the resin for upgrading extender-type plasticizers; suggest applications in other products; and present information on the resin's soap and alkali resistance. Four tables evaluate physical and electrical properties, list typical formulations, and report stabilization effects. *Resinous Products Div., Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Acetates for packaging—The Canadian Packaging Issue of the firm's house publication describes the Canadian affiliate's new pulp plant in British Columbia and contains a pictorial panorama of a variety of packaging applications for cellulose acetate. Text accents case histories dealing with adoption of eye-appealing window packages for food. Tearsheets of recent advertisements are included. *Celanese Corp of America, 180 Madison Ave., New York 16, N. Y.*

Anhydrides (Bull. F-5280A)—Uses, physical properties, and shipping data for all anhydrides produced by the firm are reported in this 16-page brochure. Considerable space is devoted to specifications with a complete description of test methods used. *Carbide & Carbon Chemicals Co., Div. Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.*

Gages (Cat. 51)—Sizes and prices of a complete line of standard ring, plug, and thread gages are listed in this well-illustrated manual. Tables and charts list tolerances and dimensions for various types. *Republic Gage Co., 2228 Fenkell Ave., Detroit 21, Mich.*

Facts about lacquer—Reasons for the ready availability of lacquer today and for the foreseeable future are contained in a four-page pamphlet which points out that, of all the production-line finishes in use today, nitrocellulose lacquer is the least vulnerable to shortages. Its availability is due to ample production capacity which is able to take care of military and essential civilian demands, and to the fact that lacquer formulations are so flexible that lacquer is not tied to any one critical material. The booklet also recommends the use of the hot-

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spray process when possible in order to conserve solvents as well as save production manhours. A number of military uses for which lacquer is now specified are included. *Hercules Powder Co., 900 Market St., Wilmington, Del.*

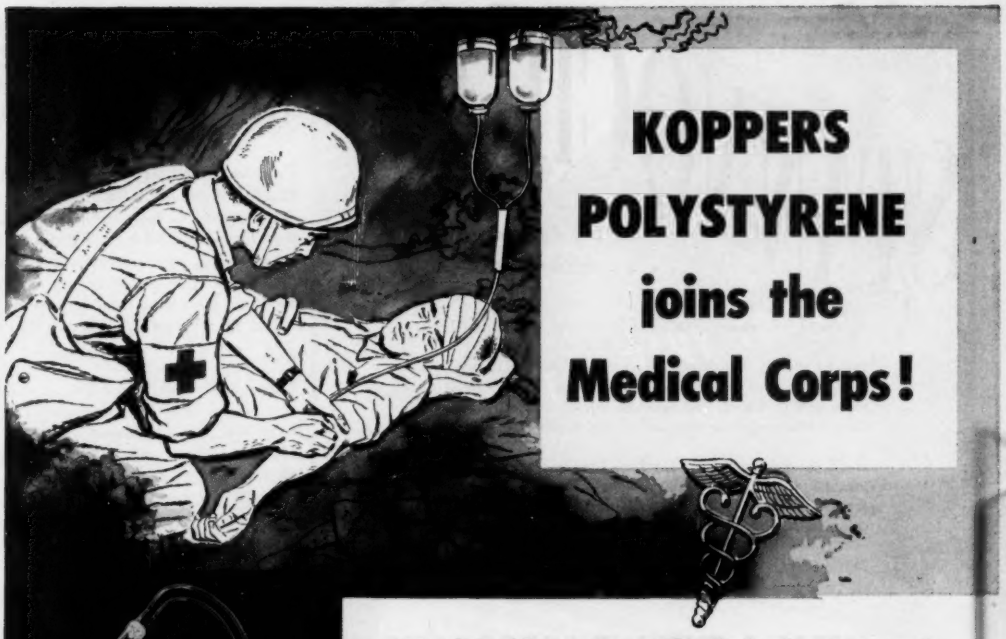
Hydrogen peroxide—A non-technical manual for plant foremen and workers contains a number of suggestions for the application of the product. Recommendations are made on the use, handling, shipping, and storing of hydrogen peroxide. A lexicon of common terminology used in connection with the product is included. *Pennsalt Chemicals, Industrial Chemicals Dept., Pennsylvania Salt Mfg. Corp., 1000 Widener Bldg., Philadelphia 7, Pa.*

How to use self-tapping screws (Bull. No. 480)—A revised edition of the Parker-Kalon Assembly Handbook covers the essentials of self-tapping screw selection, application information, recommended hole sizes, and corresponding drill size numbers. Information in this 24-page booklet has been brought up to date, and many of its tables conform to the latest recommendations of the American Standards Association. *Parker-Kalon Corp., 200 Varick St., New York 14, N.Y.*

Carbon blacks for all purposes—Categories of carbon blacks, including furnace and channel types and blacks for rubber reinforcement, inks, paints, paper, plastics, and special uses, are attractively presented in a colorful chart laminated in transparent plastic. Also available is a booklet listing carbon blacks produced specifically for rubber. *Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass.*

Elastomers and plastomers—Claiming that we are now in the Polymer Age, this second of a series of company folders lists the firm's services available to the polymer field, including: product development, product evaluation; trouble shooting; evaluation of new materials; and analysis. *Foster D. Snell, Inc., 29 W. 15th St., New York 11, N. Y.*

Research in production engineering—Laboratory illustrations and selected case histories portray the institute's production research activi-



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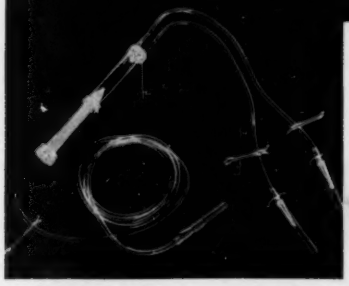

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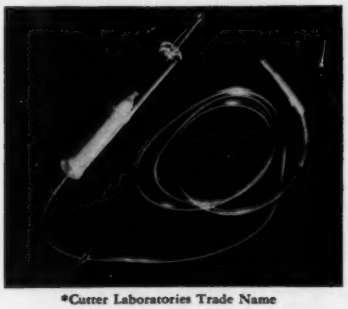

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ties in this new booklet which outlines the scope of the organization's work, details its functions, and lists the services it offers industry. *Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio.*

Constant delivery pumps (Bull. 46601)—Schematic drawings, charts, and pictures present information in this four-page folder on three new heavy-duty, constant-delivery axial piston pumps for pressures up to 3000 and 5000 p.s.i. *The Oilgear Co., 1576A W. Pierce St., Milwaukee 4, Wis.*

Instrumentation film—The growth and significance of instrumentation is chronicled in a narrated 30-min. 16-mm. color movie "Information At Work," which is aimed at professional instrument men, technical and engineering undergraduates, school science classes, and diversified audiences. *Taylor Instrument Companies, 95 Ames St., Rochester 1, N. Y.*

Liquid controls—The extensive line of liquid handling equipment produced by the concern is described in this brochure along with other products and services offered by the company and its subsidiaries. *Bowser, Inc., Fort Wayne 2, Ind.*

Molding services—Under the title, "More Men and Machines to Produce Your Products of Plastics Better," this illustrated brochure presents information on facilities available for plastics molding. Included are pictures and listings of the firm's presses, a section on special departments, and information on the scope and applications of company activities. *Plastics Div., General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.*

Translucent color chart—The important property of translucency found in Polyplastex is appealingly demonstrated by a new color chart containing eight outstanding Polyplastex materials. When the chart is held up against light, the translucent quality of the displayed materials becomes readily apparent. *Polyplastex United, Inc., 1385 Commerce Ave., Bronx 61, N. Y.*

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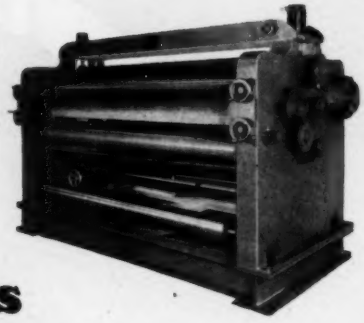

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Perforated materials (General Cat. No. 62)—Complete listings of the materials which this company perforates and the manner and styles of perforating are contained in a 128-page booklet. Materials listed under the heading of plastics, which are available in the form of sheets and coils, are acetate, celluloid, cellophane, phenolic, laminates, imitation leather, masonite, plywood, polystyrene, vinyl, and others. *The Harrington & King Perforating Co., 5655 Fillmore St., Chicago, Ill.*

Vinyl wire and cable insulating and jacketing compounds—The salient properties and many uses of Vinylite are described in this 28-page booklet. Charts indicate the uses of Vinylite electrical insulating plastics and jacketing. Color charts and technical data sheets are also included. *Bakelite Co., Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N.Y.*

Nitrosyl chloride—A complete review on the properties and reactions of nitrosyl chloride is contained in this 80-page book. The work is a reprint of a report prepared by the staff of the Nitrogen Div. Lab., and represents a digest of over 700 references and abstracts. *The Solvay Process Div., Product Development Dept., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Packaged electric power (Bull. 5600)—Methods for obtaining electric power equipment for quick expansion at low cost and with a minimum of critical materials are outlined in this 24-page bulletin titled "Electric Power for Industry's Third and Biggest Expansion." The publication describes how "packaged" electric systems simplify plant engineering problems, cut equipment and installation costs, conserve vital materials and manpower, and insure quick delivery of equipment. Other data include: how to plan, order, and install systems; protection and safety features; and flexibility. *General Electric Co., Schenectady 5, N. Y.*

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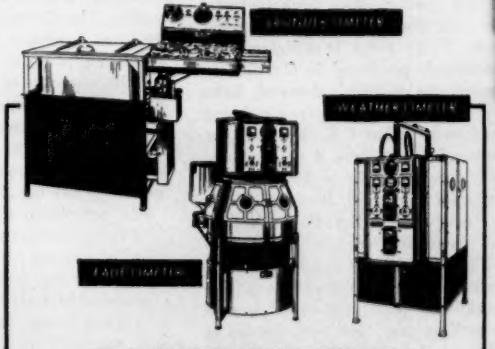

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INTERNATIONAL PLASTICS NEWS*

Activities Around the World of Interest and Importance to the Plastics Industry in the United States

Plastics in Brazil—An indication of the present status of the plastics industry may be gleaned from recently published[1] estimates that there are 500 injection molding machines, 250 compression molding presses, and 80 extruders in use in that country. Some 12,000 persons are employed in an estimated 250 plastics plants representing a capital investment of about 500 million Cr$[2].

The present-day plastics market in Brazil is divided approximately in the following manner:

Casein plastics	1%
Cellulose nitrate	2
Cellulose acetate	4
Methyl methacrylates	3
Phenolic and urea resins	20
Polyethylene	10
Vinyl resins	20
Polystyrene	40
	100%

First plastics made in Brazil were all manufactured from imported materials, and imports still are necessary for the majority of the country's production. Importation is chiefly from the United States and England.

Brazilian production of synthetic molding materials began with phenolic molding powders made of imported phenol and formaldehyde, the only domestic part being wood flour. Today there is sufficient formaldehyde produced in Curitiba to exceed the country's demand; hexa and paraformaldehyde are also being produced. Alba S.A. in Curitiba, Parana, can produce 4 to 5 tons of 40% formaldehyde in 24 hr., using imported methanol. Some colorants are produced in Sao Paulo, but all the phenol still must be imported.

Phenolic molding powders are produced in three small plants in Sao Paulo with an annual production of something over 1000 tons, divided as follows: Resinbra S.A., 60 tons per month; Plastiresina Ltda., 35 tons per month; Sacra S.A., 15 tons per month.

Importation of phenolic molding materials is at a rate of about 600 tons per year. Such imports, however, are subject to restrictions or complete prohibitions from time to time, for the protection of the domestic industry.

Urea molding powder is mostly imported. There is some small production of this material by Sacra S.A. and, on a larger scale, by Alba. Urea and cellulose filler are also imported. Cellulose acetate molding powder is reportedly being produced by Rhodia Brasileira, Sao Paulo, from all-domestic materials. Acetate sheets, however, are imported.

Polystyrene is being made of imported monomer by Bakol Co., near Sao Paulo. This production may satisfy, at the most, about half the present demand and is planned to be enlarged. The Companhia Brasileira de Plasticos "Koppers," controlled by Koppers Co., Inc., is building another new polystyrene plant in Sao Bernardo.

Raw Materials—The plastics raw material situation in Brazil is not very inviting. The coal deposits in the states of Santa Catharina and Rio Grande do Sul are small and of poor quality. The Companhia Siderurgica Nacional produces some benzol in its coking plant at Volta Redonda, but the quantity is not sufficient to encourage production of synthetics. The output figures for 1950 were about 1600 tons of benzol and 500 tons of toluol; phenol is not recovered from the tar oils.

The petroleum industry, seen as "the future richness of Brazil" because of existing petroleum deposits, is only starting. There is one small refinery at Mataripe, Bahia, and another one being built at Cubatao near Santos. This latter may supply some of the materials needed for chemical syntheses.

In spite of the immense Brazilian forests, wood as a material is a problem, being dependent on transportation facilities, which are in most cases non-existent. For this reason the price of wood is very high; purified wood cellulose is not yet being produced in Brazil.

Some 10 years ago Brazil became interested in Caffelite, a plastic made out of coffee beans, which was to replace phenolic and urea molded products. The Departamento Nacional do Cafe purchased the manufacturing license and the pilot plant from the American inventor, and a large scale plant was planned in Sao Paulo. This scheme seems to have lost importance and is no longer discussed among the present day plastics problems.

A recently published[2] estimate of the annual demand for plastics materials in Brazil, compared with the existing domestic production, given below, is based on data from Sao Paulo plastics industries, where the majority of this manufacture is concentrated.

Materials	*Annual demand*	*Domestic production*
	tons	*tons*
Polystyrene	4000	3000
Polyvinyl resins	3400	—
Phenolic molding compounds	2000	2000
Urea molding compounds	2000	300
Cellulose acetate	600	600
Polyethylene	1100	—
Melamine resins	30	—
Methyl methacrylates	10	—
Total	13,140	5900

These figures must, of course, be considered as very approximate guesses, since official statistical figures are not available. Cellulose nitrate, which is omitted here, may be guessed to be about 10 tons per year, all imported.

Melamine, methyl methracrylate, polyethylene, and cellulose nitrate are all imported; none of those materials is produced in Brazil, although large amounts are consumed.

At least three large financial groups, one Brazilian and two foreign, are said to be studying the possibility of producing vinyl resins from Brazilian raw materials. The necessary investment to erect a production plant is reported to be 50

* Reg. U. S. Pat. Office.
[1] Latini, O Brasil Produz Plasticos; O Observador Economico e Financeiro, February 1951 (Rio de Janeiro)
[2] One U.S. dollar = 18.7 Cr$

[2] O Observador Economico e Financeiro, February 1951 l.c.

Hats, courtesy John-Frederics, Inc.

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million Cr$. The price of the annually imported 3400 tons of material by the processing plants is about 70 million Cr$. In this connection it may be noted that the price of plastics products made in Brazil is about twice that of imported products.

Machines—Most of the injection molding machines in present use in Brazil have a shot capacity of between 1 and 8 oz.; there are, however, a few machines of up to 60 ounces. The large machines are in use for producing refrigerator parts, the manufacture of which has grown rapidly in recent years. The molding plant of Trol S.A., Sao Paulo, is reported to be installing a 70- and an 80-oz. injection molding machine.

The compression molding presses range from the smallest devices up to 300-ton units. De La Rue Plasticos, Santo Amaro, operates one 850-ton press for molding large radio cabinets. The extruders, mostly employed for wire coating, range from 1 to 3½ in. in size.

Before World War II, most of the plastics processing equipment was German made; now American and British machines predominate. Hand-operated and semi-automatic injection molding machines, as well as compression molding presses, are also made in Brazil.

Most Brazilian molding plants have shops where simple molds are made or rebuilt. Special steels, however, must be imported. A few high precision molds are made, such as for radio cabinets, but molds of more complicated types are, as a rule, imported.—*Louis A. Helwich.*

French license for polyethylene bottles—An exclusive license to manufacture polyethylene bottles and double-walled cosmetic jars has been granted to Ste. Laroche Freres, 46 Rue des Marais, Paris, France, by Injection Molding Co., 3823 Independence Ave., Kansas City, Mo. The French firm will produce these containers on a royalty basis under U.S. patents and patents pending.

Industrial chemical show in Paris—As part of the celebration in honor of the 2000th anniversary of Paris, the 24th International Congress of Industrial Chemistry will be in session from Nov. 25 to Dec. 1 in the French capital. Plans for the Congress include a presentation of all non-commercial objects and appa-

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ratus which have been developed through special laboratory research, and a display of technical periodicals dealing with fields which utilize chemical applications. The Congress is interested in receiving papers from members of the plastics industry which will be read and discussed at the conference.

Running concurrently with the Congress will be the First Chemical Show consisting of an exposition of equipment, material, and products of interest to factories and laboratories. Space will also be devoted to a display of posters reviewing varied trade activities.

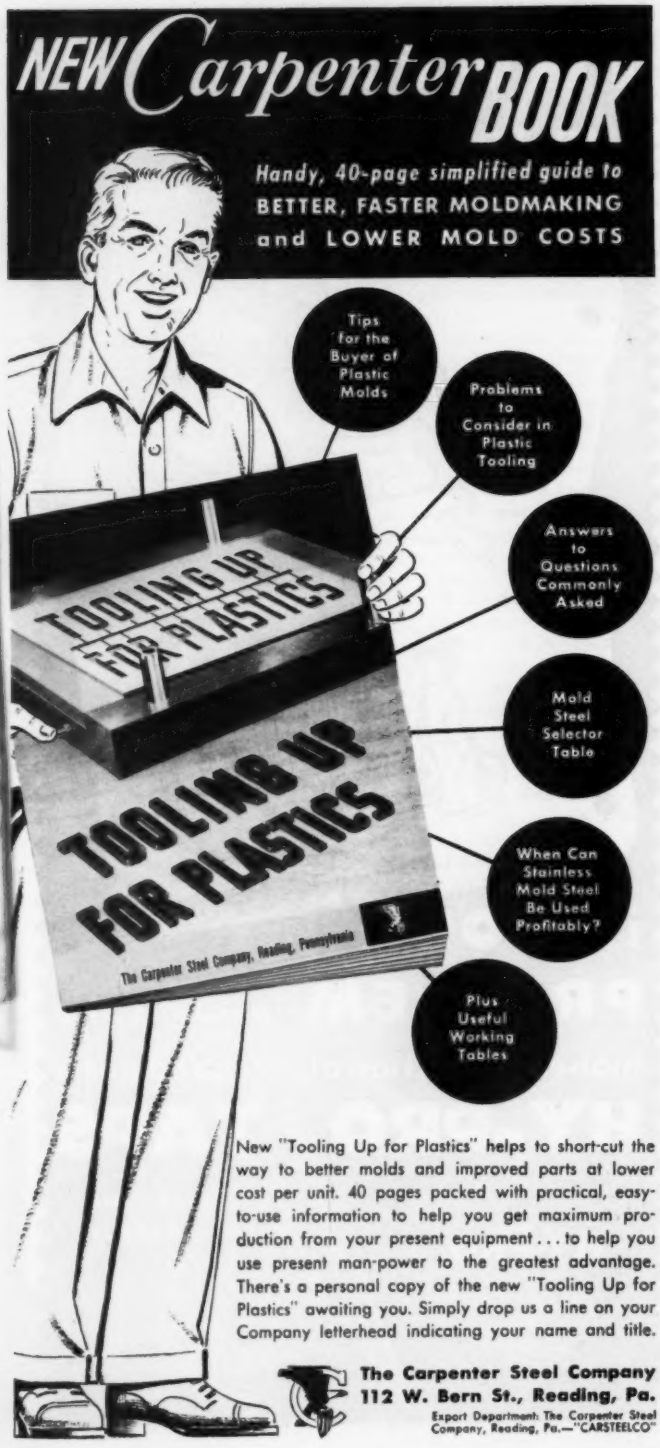
Progress in Australian plastics—Annual report of Moulded Products (Australasia) Ltd., Melbourne, Australia, includes a survey of the growth of the plastics industry in that country from 1939 to 1949 which shows that the total quantity of plastic materials used increased 43 times; quantity of plastic materials imported increased 15½ times; number of different enterprises in the plastics industry increased from 35 to 195; and the number of people employed in all branches of the industry increased 4½ times.

The company reported a net profit of £72,510 ($203,028) for the year ending Dec. 31, 1950, which compares with a net profit of £44,873 ($125,644) for the previous year.

The report includes a summary of the activities of the firm's factory units and its subsidiary distributing companies.

Plastics and cement used in Dutch tunnel—Properties of Portland cement can be considerably improved by incorporating small quantities of water-soluble plastics (cellulose derivatives) into the concrete mix. One of the larger applications of this improved concrete is in the auto tunnel under the Maas River in Rotterdam, Holland, which was built in 1940.

Tiles could not be used for the ceiling of the tunnel because of the risk of falling, so a suitable plastering paste composed of cement, extenders, and a cellulose ether was developed by W. Dorst of Chemisch-Technisch Adviesbureau and Dr. J. Rinse, now of Chemical Research Associates, Bernardsville, N.J. The paste does not run on vertical walls and dries without cracking, leaving a hard, smooth surface which can be easily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rendered in relief. The same paste product has been used for other industrial and decorative purposes in Holland.

Water-soluble urea resins for printing inks—Use of water-soluble urea resins is widely known for such applications as core binders, adhesives for plywood, and means of improving crease resistance of fabrics. There are, however, other uses, for these resins which have not claimed much attention.

One water-soluble resin developed in Holland during the war was used for printing inks when mineral oil was scarce. The inks were rapid drying and gave good results on a large newsprint press. At that time the shortage of carbon black and paper became more serious than that of mineral oil, and printing was cut back so far that this use of urea resins became superfluous.

Another interesting application of water soluble urea resins is in combination with gypsum. Part of the water of the urea solution is fixed in the calcium sulfate hydrate and, at the same time, the aciduous gypsum acts as a catalyst for setting the urea resin. After processing, a hard, solid mass is obtained, with only slight shrinkage, which consists of hydrated gypsum reinforced by a solid urea resin. Such castings are superior in mechanical properties to gypsum plaster. The urea resin needed for this purpose should not solidify too quickly. Because of the relatively low cost of urea resins and because the resin constitutes only a minor part of the mixture with gypsum, the cost of the castings is only slightly higher than that of straight gypsum plasters.

Coated industrial belts—Plastic coated glass silk fabric developed by Glassfibrex Ltd., Glasgow, Scotland, is being used as belting on machines for manufacturing confectionery, in chocolate factories, bakeries, and biscuit plants, and in the dairy industry. The material insures hygienic handling of these foods because it is resistant to vermin, rot, damp, acids, and other corrosive factors. Previous belts of rubber or textile composition had been found to fray, warp, or otherwise suffer under the impact of temperature changes in ovens or under refrigeration.

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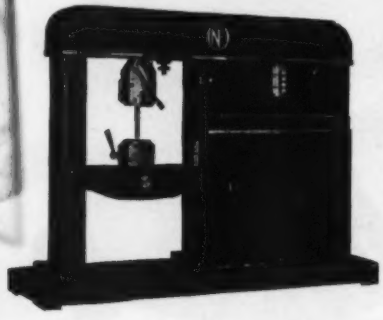

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

Materials	*Total p'd'n. first 6 mos. 1951*	*Total sales first 6 mos. 1951*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	8,146,349	8,137,128
0.003 gage and over	6,320,014	6,280,478
All other sheets, rods and tubes	3,345,696	3,185,713
Molding, extrusion materials	38,182,767	36,071,997
Nitrocellulose:		
Sheets	3,799,385	3,241,493
Rods and tubes	589,349	634,570
Other cellulose plastics[b]	6,710,362	6,537,451
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	42,460,211	29,581,455
Adhesives	21,811,656	19,846,286
Molding and casting materials[a]	122,492,832	108,867,107
Protective coatings (unmodified and modified except by rosin)	14,512,662	10,776,626
Miscellaneous uses	39,479,273	38,302,241
UREA AND MELAMINE RESINS:		
Adhesives	46,845,130	43,732,922
Textile-treating resins	14,308,420	11,810,381
Paper-treating resins	8,259,914	7,776,929
Protective coatings, modified and unmodified	16,213,951	11,270,784
Miscellaneous uses, including laminating and molding[c]	46,672,575	41,131,887
STYRENE RESINS:		
Molding materials[a]	122,480,776	118,491,852
Protective coatings, modified and unmodified	21,821,169	20,739,177
Miscellaneous uses	28,840,717	25,714,399
VINYL RESINS:[d] Total	223,556,674	210,095,669
Sheeting and film (resin content)[e]		85,838,584
Adhesives (resin content)		6,604,016
Textile and paper-treating resins (resin content)[f]		22,511,192
Molding and extrusion materials (resin content)		70,796,400
Protective coatings (resin content)		13,537,040
Miscellaneous uses (resin content)		10,773,437
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	86,882,675	86,229,335
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a, g]	38,614,816	34,878,808
Protective coatings[h]	9,267,899	10,738,349
All other uses[i]	54,332,393	51,193,109

[a] Dry basis unless otherwise specified. † Revised. [b] Includes fillers, plasticizers, and extenders. [c] Includes sheets, rods, and tubes, and molding and extrusion materials. [d] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [e] Production statistics by uses are not representative, as end-use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

May 1951		June 1951	
Production	*Sales*	*Production*	*Sales*
1,281,868	1,327,764	1,443,924	1,526,588
1,113,559	1,082,284	951,700	922,649
493,158	483,286	532,102	479,831
6,099,795	5,909,966	6,154,469	6,093,848
644,898	499,009	679,441	507,848
81,290	83,360	83,704	96,712
1,152,078	972,589	872,181	913,985
7,458,897	5,232,212	6,349,141	4,459,165
3,904,580	3,315,085†	3,427,928	3,376,877
20,867,445†	18,885,527†	20,825,718	18,259,146
2,315,471†	1,826,696†	3,459,882	2,662,536
7,300,912†	6,899,992†	6,508,914	6,234,094
6,475,482†	6,383,862†	6,159,184	5,395,167
2,101,178†	2,126,447†	1,949,177	1,762,767
1,275,139	1,390,484†	1,534,266	1,576,159
2,275,388	1,514,579†	2,232,782	1,352,331
8,623,570	7,785,817	7,400,460	6,553,113
22,133,439	20,455,814	22,754,347	21,450,950
4,018,614	3,736,356	4,030,742	3,521,034
5,102,572	4,285,480	4,360,532	3,590,764
39,733,885†	35,999,827	39,166,218	37,168,723
	13,856,471		14,143,603
	1,462,894		1,591,451
	3,894,073		3,853,268
	12,662,641		13,357,200
	2,011,529		1,761,872
	2,112,219		2,461,329
14,512,118	14,618,894	13,227,134	13,217,928
6,408,779	6,161,725	6,279,896	5,502,418
1,659,747	2,209,820	1,367,434	1,410,665
9,731,246	9,160,309	9,380,626	8,329,963

tion are given. ° Prior to January 1951, statistics were given on the basis of total weight. ᶠ Includes data for spreader and calendering-type resins. ᵍ Includes data for acrylic, polyethylene, nylon, and others. ʰ Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. ⁱ Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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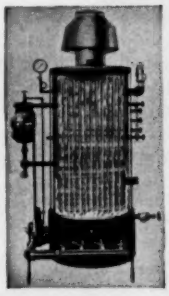

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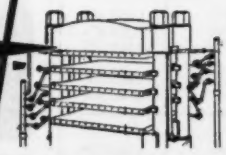

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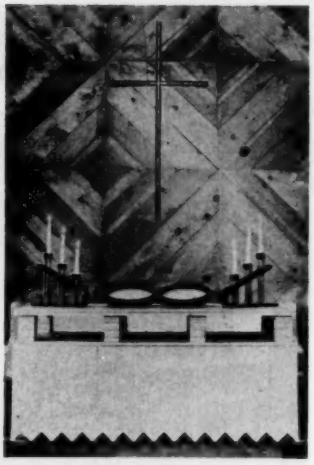

Cross, candelabra, collection plates are fabricated of blue and red acrylic

Altar Pieces

THE ability of acrylic to simulate closely the colors and textures of medieval stained glass has led to the selection of this material for a cross, candelabra, and collection plates at the Presbyterian Church in Burney, Calif. The five-piece set was produced in Plexiglas medium blue #316 and fluorescent red #587 by San Francisco Plastics Co. James H. Mitchell, architect and designer of the church, created the plastic set.

The cross, measuring 4 ft. 1 in. by 2 ft. ½ in., required ¼-in. flat sheets laminated to a ½-in. thickness. Outside angles were first fabricated to form the cross outline; then the center red cross was set in. Alternating blue crossbars and red blocks filled in the remainder.

Rims and bases of the 11½-in. diameter collection plates were heat formed of ⅛-in. strips of laminated blue, red, and blue acrylic.

Bases of the candelabra were made of blue laminated Plexiglas; they taper from a width of 4 in. at the bottom to 2 in. at the highest point, and were formed to the required angle. Candle holders were formed of red acrylic with a blue strip at the upper end and a flat red piece across the top. Holders were set through slots installed in the bases. A lead weight was inserted invisibly in the bottom of each candelabrum.—*Ruth Teiser*

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EXTRUDED PLASTICS. Brochure describes the latest applications of custom made thermoplastic extrusions. Includes data on curved and spiral extrusions as well as on more conventional types. Shows many suggested end uses. Anchor Plastics Co., Inc. (A-74)

LATEX FOR PAPER IMPREGNATION. Techni-Guide contains data on Chemigum Latex 245B, a nitrile latex designed for impregnation of paper pulps at the beater. The Goodyear Tire and Rubber Co., Inc. (A-75)

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TWIN SCREW EXTRUDER. The specifications and features of the R. C. 100 twin screw extruder for all thermoplastics are contained in a folder published by R. H. Windsor Ltd. (A-83)

CEMENTING POLYSTYRENE. Technical manual explains the techniques involved in cementing polystyrene to polystyrene and to other non-porous and porous surfaces. Monsanto Chemical Co. (A-84)

PROCESSING EQUIPMENT. Latest issue of *The Waldron Window* (a house organ) shows various machines being built and reports company activities. John Waldron Corp. (A-85)

FLEXOL PLASTICIZER. Technical information on the physical properties and compatibility of Flexol plasticizer R-1, a new non-migrating polyester designed for use with the vinyl chloride resins. Carbide and Carbon Chemicals Corp., Unit of Union Carbide and Carbon Corp. (A-86)

MOLD AND DIE MAKING EQUIPMENT. Booklet contains information about die-sinking and engraving machines designed and built to meet the needs of modern mold and tool work. Complete specifications and descriptions. Price list included. J. Arthur Deakin and Son (A-87)

VINYLITE RESINS AND PLASTICS. Forms, properties, and applications of vinyls, presented in non-technical language. Covers both rigid and non-rigid vinyls with suggestions on use in various manufacturing processes. Property data tables. Bakelite Co., a Div. of Union Carbide and Carbon Corp. (A-88)

FIRESTONE VELON FILM. Booklet containing source material on vinyl film which should be of interest to retail stores. Covers basic and specific advantages for many types of products into which Firestone Velon film is most commonly fabricated. Firestone Plastics Co. (A-89)

RESIN-TREATED PAPERS. Brochure describing Phenopreg RP materials which are resin-treated papers that can be used in the surfacing of plywood, veneers, and various types of construction boards. Fabricon Products, Inc. (A-90)

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VINYL STABILIZERS AND PLASTICIZERS. Folder describes several plasticizers and stabilizers for use with vinyl resins. Includes specifications, applications, formulas, and other laboratory data. Advanced Solvents and Chemical Corp. (A-92)

UNPLASTICIZED PVC. Bulletin on Geon Resin 404 for applications which require a rigid vinyl material. Contains data on tensile and flexural strength, physical properties, impact and chemical resistance and processing methods. B. F. Goodrich Chemical Co. (A-93)

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Top: Shape of 80 oz. polyethylene acid bottle reduces tipping hazard. Spout, left, has phenolic handle and collar, polyethylene collar, tube, spout, cap

Acid Bottles

SAFETY pouring spouts of unusual design are an outstanding feature of two polyethylene containers recently developed in England. Known as Poly-Tainers, these bottles were developed by Industrial Appliances Ltd., London, with the cooperation of British drug houses which use the containers mainly for shipping hydrofluoric acid to all parts of the world, as well as for laboratory handling of dangerous chemicals. Resistance of polyethylene to the attack of most chemicals makes the material ideal in this application.

The new containers with safety spouts are made in 16- and 80-oz. sizes, the smaller one being of conventional round design and the larger one of a special shape which reduces the danger of tipping. Both are produced by blow-molding on semi-automatic machines.

Cross-section of blow-molded 16-oz. bottle for handling dangerous fluids

Provision is made in the safety pouring spouts for entry of air to the container as the liquid is poured out. This is accomplished by clever design of the molded polyethylene cap. The nozzle of the spout itself is divided by a horizontal molded-in strip to provide two passageways. One passageway ends in a hole opening directly into the container; the other ends in a flange into which fits a curved polyethylene tube. As the container is tipped to pour, the open end of the tube comes clear of the liquid in the container and permits entry of air through the upper passageway in the nozzle; the liquid pours through the lower passageway. Thus the contents may be poured quickly and in a steady stream free from bubbles.

In the 80-oz. bottle, the molded polyethylene spout screws onto a collar molded of black polyethylene. This assembly makes a liquid-tight seal to the mouth of the container when another collar, molded of phenolic, is screwed in place. A threaded polyethylene cap seals the nozzle.

Sealed to one of the narrow sides of the 80-oz. container is a tapered socket into which fits one end of a molded phenolic handle, the other end of which encircles the neck of the container just under the threaded collar.

It is reported that the acceptance of these acid containers in England has been very encouraging.

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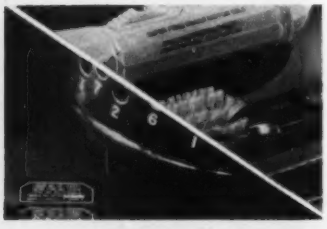

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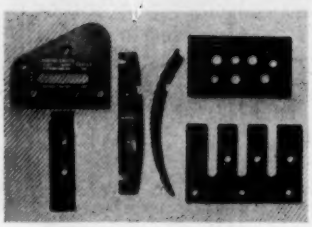

Instrument panels are of black polyester material with transparent core

Edge-Lighted Panels

EDGE-LIGHTED instrument panels for military aircraft are now being made of Sierracin 5005, a polyester material developed specially for the purpose by Sierra Products Co., Compton, Calif. The panels have black backgrounds with white markings for daytime visibility. At night, letters are illuminated in red by small bulbs whose rays pass through the transparent inner core of the panel and escape only through the translucent markings.

The panel material is integrally molded into one sheet to eliminate the possibility of delamination. It can be machined easily, with helical tooth cutters or routing tools producing the best results. It can also be formed to shape by heating the material to 240° F. for 30 min. and then forming it over rubber-covered blocks of wood or plaster. This technique was used in forming an edge-lighted throttle control panel which has a 6-in. diameter curve.

Panel markings are produced by engraving through the black and white surfaces and slightly into the transparent center core. The letters are then spray filled with translucent white plastic, allowed to cure, and the entire panel is washed with lacquer thinner.

The black surface of Sierracin panels provides a durable and nonreflecting surface. It will withstand scratches from a phonograph needle bearing more than a 1000 g. load. Thus there is little possibility of abrasion and consequent light leaks.

The material will not craze in the presence of alcohol, methyl ethyl ketone, aviation gasoline, standard commercial cleaners; thus solvents can be used to remove grease.

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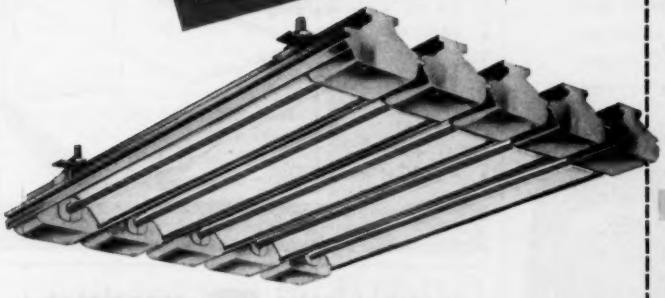

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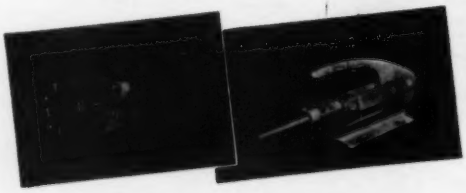

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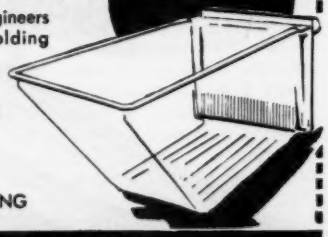

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Swedging Vinyl

SMALL objects can be quickly reproduced in Vinylite rigid sheet using a compact new method of swedging or shaping. The swedger, which consists of three integrated parts corresponding to the main steps of the swedging operation, was designed especially for dental work but is also useful to jewelers.

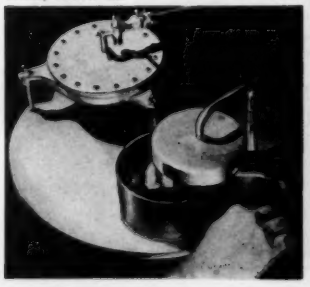
When the swedger is used to produce models of prosthetic devices, a plaster of paris dental model is first set on top of an asbestos clay compound in the swedger's movable tray. A 0.064-in. thick wafer of Vinylite is then placed on top of the model, and the tray is slid under an electric heating element where the plastic becomes soft and moldable in about 10 seconds. The tray is quickly moved under an air pressure element, and a rubber diaphragm is expanded under 25 to 50 lb. pressure to force the heat-softened vinyl against all surfaces of the model. After about 1½ min., pressure is released, and the model is removed, ready for trimming.

Exact fitting dentures, made from these plastic base plates, as well as interdental splints that give more freedom to jaw fracture patients, are made possible by the dimensional stability, flexibility, and strength of the vinyl material.

Jewelers and machinists employ the swedging method to make molds for casting metals or matrices for positioning intricate parts; other manufacturers use it to make container tops or caps. Swedged reproductions are limited to objects not over 5 in. in diameter nor over 2 in. high.

Tray containing vinyl sheet and dental model is held under heating element of swedge. Air pressure unit is at left

Courtesy Bakelite Co.



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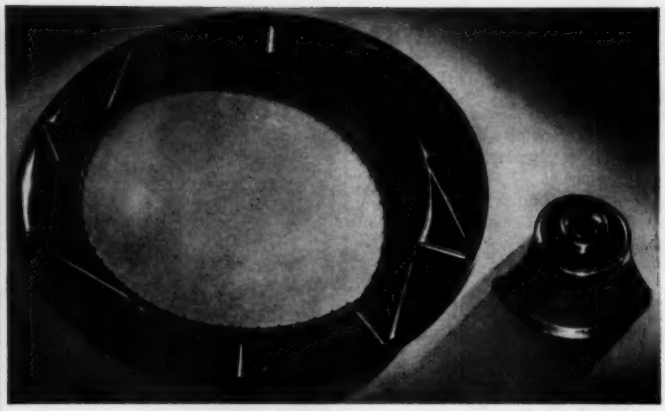


Photos courtesy Durez Plastics & Chemicals, Inc.

Serrated inner edge of phenolic tumbler ring (left) breaks or loosens vegetable skin. Cam buffer (right), to which an abrasive strip will be attached, removes skin by scraping

Phenolic Parts for Vegetable Peeler

MAJOR operating parts of a semi-portable vegetable peeler produced by Baker Mfg. Co., Marine City, Mich., are molded of corrosion-proof phenolic. The material, supplied by Durez Plastics & Chemicals, Inc., North Tonawanda, N.Y., remains unaffected by water and vegetable juices, and permits the peeler to be washed by ordinary tap water, thus eliminating possible contamination from cleaning fluids.

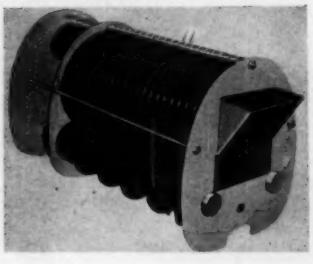
Phenolic components, which are produced by Molded Products Co., Hazel Park, Mich., are tumbler rings about 9 in. in diameter and cam segments or buffers on which are mounted abrasive strips. The inside edges of the tumbler rings have produced by Molded Products Co., serrations with fairly fine edges.

The vegetables to be peeled are fed into a hopper where they come in contact with these tumbler rings. The serrated edges break the skin of the vegetable or pick at its outer surface so that it is easily removed by the abrasive strips on the buffers. The peeling operation makes use of a scraping rather than a peeling action, which results in retention of flavor, 20% less waste, and lower vitamin loss. The construction of the unit assures complete peeling of a variety of sizes and shapes at one time.

Incorporation of the phenolic components helped keep production and part costs down. The molded phenolic parts are used interchangeably in two sizes of the vegetable peeler. Models weigh 35 and 55 pounds.

Left: Phenolic operating parts of peeler can quickly be washed with water

Plastic peeler consists of tumblers, top, and abrasive-covered cams, below



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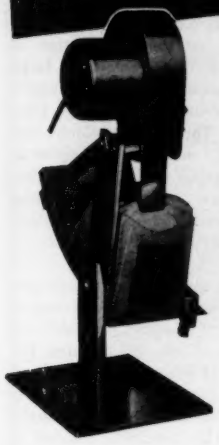

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Polyethylene Tub for Acid Bath

CHEMICAL resistance of polyethylene has led to the selection of this material for an unusually large tub for washing television picture tubes at National Video Corp., Chicago, Ill. The polyethylene tub replaces a similar Monel-metal receptacle which was falling into disrepair because of the corrosive action of hydrofluoric acid, the solution used to clean and etch the inside of T.V. tubes.

Claimed by the manufacturer, American Agile Corp., Cleveland, Ohio, to be the largest polyethylene sheet fabrication in this country, the outer shell of the tub is 27 in. high and has an outside diameter of 69½ inches. It is made of ½ in. polyethylene sheet. The bottom of the tub is made of material of the same formulation and thickness.

The tub consists of an outer shell, described above, and five inner tubes. The center tube is hand formed and welded of ½-in. sheet. The four smaller tubes, which have a diameter of 12½ in., are cast of polyethylene and have a wall thickness of ⅜ inches. A black polyethylene tube on the rim of the outer shell acts as a bumper rail to protect the glass tubes when they are being cleaned and etched in the hydrofluoric acid solution.

The manufacturer estimates that the polyethylene fabrication will last eight times longer than the metal tub which it replaces. The polyethylene tub, which weighs 487 lb., is only 40% as heavy as the one constructed of Monel.

Large polyethylene tub resists corrosion by acid used in etching T.V. tubes
Courtesy National Video Corp.

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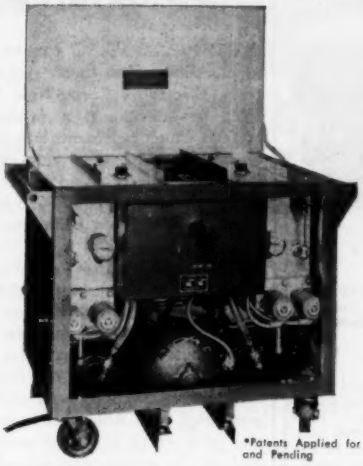

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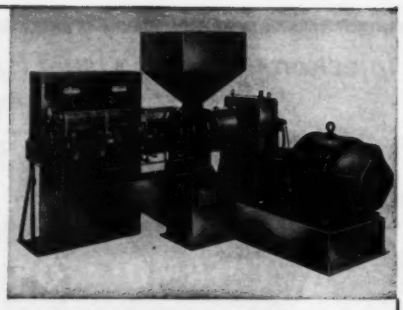

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Dry Coloring

(*Continued from pp. 96-7*)

or carrier an inorganic material. None of the inorganic pigments are soluble in water or oil. Some organic colors *are* soluble in water or oil.

Inorganic Colors

The most widely used *inorganic* colors in the plastic trade are:

Browns—iron oxide, ceramics.

Blues—cobalts, ultramarines.

Blacks—carbon blacks, ceramics.

Yellows—iron, chrome, titania, cadmium.

Reds—cadmium.

Greens—chrome oxide, ceramics.

Pinks—chrome, tin.

White—zinc oxide, titania dioxide, zinc sulfide, calcium carbonate.

Metallics—bronze powders, copper powders, aluminum powder.

Specials—phosphorescent pigments. These are the sulfides of cadmium, calcium, and zinc.

Organic Colors

The most widely used *organic* colors are:

Browns—Hansa yellow plus Red Lake C or Watchung Red.

Blues—oil blues, phthalocyanines.

Yellows—oil yellow, Hansa yellow.

Blacks—oil blacks, black concentrates.

Reds—Red Lake C, Watchung Red, oil reds, Harrison red, Rubines.

Greens—phthalocyanine greens.

Pinks—calcophyl.

Specials—fluorescent dyes.

Progress in One Year

More progress was made in dry coloring of styrene betwen February 1950 and February 1951 than had been made in the previous 10 years. To overcome the problems of streaking and poor surface finish, nozzle inserts which gave more turbulence to the melted plastic mass in the injection machines were devised. More attention was given to mold design. Preplasticizing chambers on newer injection machines tended to improve the finished product by what might be called a secondary dispersion under heat.

Molders found that they could maintain extensive inventories of crystal styrene and mix what they needed for any job, using practically all of the scrap right on that job, thereby reducing scrap inventory. It is a well known fact that styrene scrap is less workable than virgin material because the latter will mold better and will produce a better product than a plastic that has been heated and cooled.

It was to be expected that molders, having enjoyed such notable savings and ease of operation through the dry coloring of styrene, would want to extend the technique to other materials.

Not Only Styrene

Polyethylene has been colored very satisfactorily although color specks can be noted in some thin sections. Polyethylene is different from styrene as it seems to impart a static charge to the color which makes it cling together and cause specking. The remedy for this is the proper selection of colorants, the fine predispersion of color through the granules (sifting the color through a fine mesh screen), the use of the proper impediments in the injection molding nozzle, and the correct amount and type of wetting

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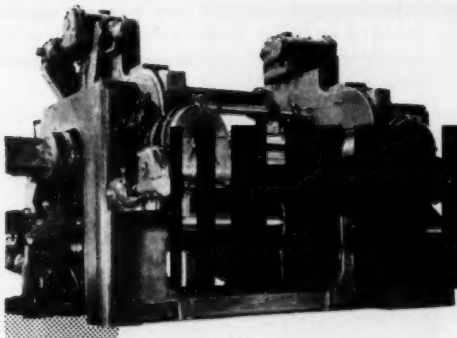

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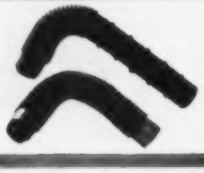

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agent. The savings made in dry coloring polyethylene, over buying colored pellets, varies from six to eight cents per lb. of material. Inventory and workability advantages can effect additional savings.

Transparent acetate and butyrate have been colored satisfactorily to produce transparent, translucent, and opaque colors. No special difficulties have been encountered in the coloring of acetate and butyrate that are different from those mentioned on coloring styrene and polyethylene. Pricewise, the coloring of CA and CAB has not been as attractive as for styrene and polyethylene. The price per pound of clear material is higher than that of colored by a few cents. It costs more to make an absolutely clear CA or CAB than to make the material into color. This type of plastic is naturally amber and the purifying costs run high. We have run trials with an unrefined grade of CA in production and found that excellent colors can be made in this amber colored material. We believe that when the time comes that plastic supply exceeds demand, various types of CA and CAB will appear on the market that will be made for dry color work.

Acrylic, Too

Dry coloring of acrylic is being done by several companies. Along with color dispersion problems, acrylics are very sensitive to small amounts of moisture in a color, and are probably more affected by the type of color used in dry coloring than any of the above mentioned plastics. Certain dry colors used in acrylics give an etched or laminated surface. We have found that the lower the melting point of the acrylic molding powder, the easier it is to dry color.

Nylon can be dry colored satisfactorily, but due to its numerous molding problems the molder in most cases does not wish to experiment with dry coloring this material. Some molders are working with dry colorants on nylon material and the general finding is that the color does not make nylon any trickier to mold.

Dry coloring of calendered products is not new, for many companies have used dry colors in vinyl work for many years. Dry colors fit into this picture very readily as they can be added with the plasticizer, filler, and other ingredients in the Banbury or similar type of mixer. Other calendered plastics can also be easily colored. The most generally accepted process to date is to dry blend the coloring and the resin, then to add the wet materials and take the whole through a mill before putting into the calender.

Extruded plastics materials are very easy to color from clear to a solid color. The major troubles encountered here are that a few colors clog the screens in the extruder used for thin film. Certain colors will not clog these screens as easily as others. One of the worst offenders in extruder clogging is ultramarine blue.

Compression Molded Materials

The problem of coloring compression molded or cast materials is different from that of coloring materials that are injection molded.

Melamine resins can be colored quite readily by the use of either a colloid or ball mill. In the case of a colloid mill the color and resin should be premixed in a tank with

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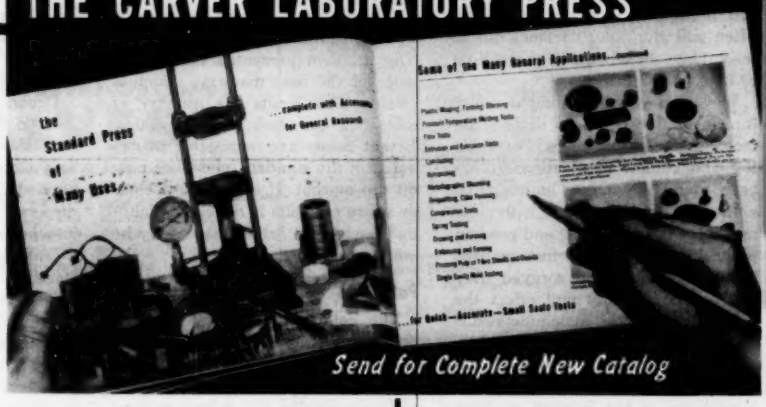
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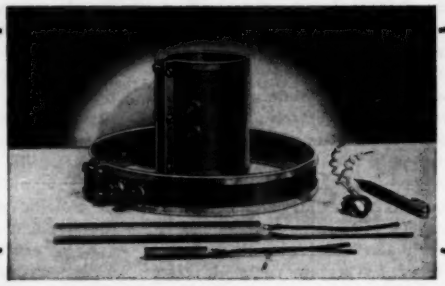

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a stirrer attached, before being passed through the mill. Colors that are premixed, then colloid milled, often will give color variance due to incomplete dispersion in the colloid milling.

Wet or dry ball milling of color into melamine has been done satisfactorily for many years. For table top and similar applications it has been found that paper impregnated with color, then over-laid with clear melamine gives a better end product than when the color is incorporated in the melamine and sprayed over white paper. Colors will affect the set and cure of the melamine resins so as to present many plant production problems. An advantage of colored paper over melamine is in the wearability of the finished product. When a colored melamine wears off, it will show the white paper background. When using colored paper the merchandise remains the same color even when the melamine is practically all worn off. This is very important in applications such as counter and table tops where the surface is subjected to heavy abuse.

Urea resins can be dry colored by ball milling the color into the resin. This process has been followed for many years.

Phenolics can also be dry colored by milling the color into the resin. The problem presented here is the color of the base material, which is brown. This limits the number of colors to the dark, duller shades. Bright colors are impossible to develop in the standard phenolics now on the market. If and when a clear or white phenolic is developed, normal pastel and bright colors may be made.

Polyesters

The coloring of polyester resins presents a very difficult dispersion and compatibility problem. The dispersion problem is solved by the use of finely divided dry colors or predispersed colored pastes. Dry colors have the advantage of being cheaper than pastes and they do not present a caking or hardening problem after being stored for long periods of time. Many colors either affect the set or maturing time of the resin, or are affected by the catalysts used in the process. Some colors are so affected that they will change from one shade to an altogether different shade. Other colors do not change shades but act as catalysts, and will set the resin up in a few minutes. Still other colors will retard the resin set time, so that the resin never becomes hard.

Organosols and plastisols can be colored normally with the general run of colors used in vinyls. The only trouble here is a matter of dispersion. Many vinyl colors do not disperse well and have to be made into pastes, but some pastes present a caking or drying problem on standing, and are not easy to handle. Special dry colors have been developed that have a small particle size (like fine talcum powder). These colors disperse well and do not speck or streak. There is a place in organosol and plastisol coloring for both master batch mixing and for dry colorants.

Heat Limits Colors

High temperature plastics such as Kel-F, Teflon, and the silicones require pigments that are stable at 700 to 800° F. The majority of organic colors will decompose at these temperatures, leaving only some of the pigment colors available for this

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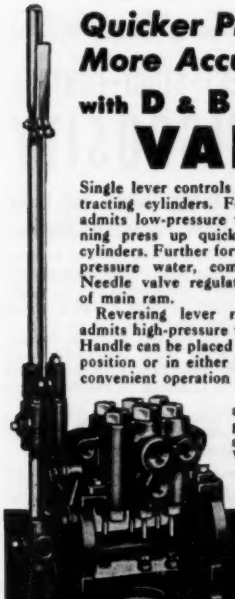

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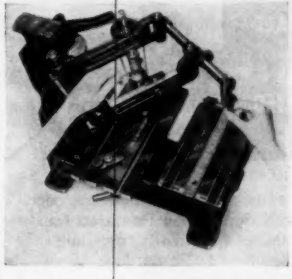

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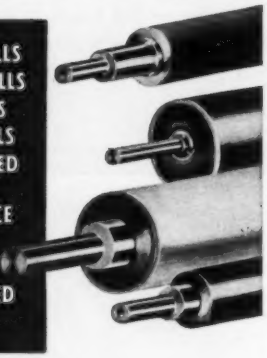

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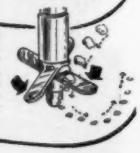

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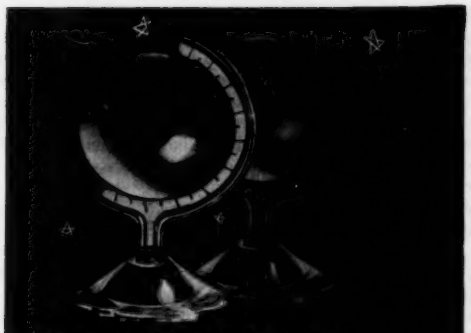

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A 1500 watt dielectric heater built *up to a standard*, not down to a price. Raises temperature of 1½ lbs. of plastic, other average materials, 170 degrees in one minute. High quality components and construction prevent expensive breakdowns, allow continuous operation.

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work. All ceramic colors will do a good job in these plastics, as will red iron oxide, cadmium yellow, orange, red, and maroon. Colors that are borderline cases (i.e., will work in some formulations but not in others) are umbers, ultramarine blue, carbon black, phthalocyanine green.

Interesting comment on present molding trends is that, with increased heat in injection chambers, colorants are having to be developed that will stand up to very high temperatures in the molding process. It is probable that these colorants will be found more acceptable for the high temperature plastics.

Following is a list of companies producing blended colors:

Claremont Pigment Dispersion Corp., 110 Wallabout St., Brooklyn, N.Y.; Ferro Corp., Cleveland, Ohio (also Los Angeles, Calif.; Oakville, Ontario, Canada; and Voltastraat 2, Rotterdam, West, Holland); Gering Products, Inc., Kenilworth, N.J.; H. Kohnstamm & Co., 537 Columbia Ave., Brooklyn, N. Y.; Krieger Color and Chemical Co., Inc., 6531 Santa Monica Blvd., Hollywood 38, Calif.; Mid-America Plastics Inc., Cleveland, Ohio.

Plasticizers

(*Continued from pp.* 106-107)

is in lacquer and smokeless powder. The latter two products will show large increases in 1951. It is seldom used in vinyl—as it is too volatile.

Diethyl phthalate is used for plasticizing cellulose acetate and in certain types of powder.

Di-2-ethylhexyl phthalate is more familiarly known as DOP. As the tabulated figures indicate, it is by far the most widely used of all vinyl plasticizers. It is perhaps the closest there is to an all-purpose plasticizer, but portions of other plasticizers are frequently used with it to improve low temperature flexibility, flame resistance, etc.

Expanded Facilities

Di-iso-octyl phthalate, or DIOP, is very close kin to DOP. Some vinyl processors use the two interchangeably or even mix them. Iso-octyl alcohol is used with phthalic anhydride instead of 2-ethylhexyl alcohol as in DOP to synthesize the material. When ethylhexyl alcohol was scarce, iso-octyl came into demand. In addition to enlargement of Enjay's present facilities by three or four times, it is reported that both Gulf Oil and Standard of Indiana will come into production sometime in 1952 on iso-octyl alcohol for sale to companies now manufacturing DIOP. The figure of 2½ million lb. in Table I as the amount produced in 1950 is misleading. There is a lot of it in the item "All other" further down in the listing, but it can't be clearly identified because these "All other" materials are frequently combination products and contain not only DIOP but other chemicals.

Also included in "All other" are various phthalates as listed under that heading in Table II. Nearly all of this listing is the type plasticizer used for vinyls. Dicapryl and octyl decyl phthalates are among them—supplies of normal octyl alcohol and normal decyl alcohol are limited. They are obtained from cocoanut oil. Others are the Goodrite octyl phthalate-type plasticizers; Barrett's butyl cyclohexyl (50B); Monsanto's butyl benzyl (Santicizer 160).

Another plasticizer included in this group, but not used for vinyl, is dicyclohexyl phthalate, which is

used largely for cellophane. Nearly all of the plasticizers used for vinyl mentioned above are all-purpose plasticizers and can be classified as "primary," but most of them are used for blending to impart some particular property to the end goods.

Bug Repellants

Dimethyl phthalate is used for cellulose acetate; a small amount in 1950 went for insect repellants. Much more will be diverted to that purpose in the defense program. Both diethyl and dimethyl were extremely short during World War II because of their military uses, including the bug repellants.

Dimethyl Cellosolve phthalate is also used in cellulosic formulations. "All other cyclic plasticizers" is a category that contains not more than a million lb. used for vinyls. The second footnote tells what they are. A little coumarone indene is used for ethyl cellulose; a small amount of camphor is still used for nitrate; toluene sulfonamides are used primarily for nail polish.

Nearly all plasticizers based on adipic acid esters are used in vinyls, including iso-butyl adipate for saran. Butyl Cellosolve adipate was also used for polyvinyl butyral safety glass sheeting in 1950. That portion of the adipate esters used for vinyl chloride and copolymer formulations is primarily intended to impart low temperature flexibility in such items as garden hose.

Lauric acid esters are seldom used with vinyl—one of their chief uses is as a dispersing agent in textile treatment.

Oleic acid esters as listed in Table I, except those mentioned at top of Table I, are seldom consumed in vinyls. They are mostly for rubber and for textile dispersing agents.

Oldest Type Increases

Under phosphoric acid esters, one of the oldest used for vinyl chloride formulations is trioctyl phosphate (TOF). Probably less than one million lb. was used during 1950, but the use may run several times this volume in 1951 because the chemical imparts the particular properties of low temperature flexibility and flame resistance which are so necessary in military applications. It has never been widely used in civilian applications because it is a bit more costly than DOP, and there have been some stabilization problems. There has also been a lack of knowledge of how to use it. This latter point has now been overcome, thanks to the military program, and it is possible that TOF may be much more widely used for civilian goods in the future.

Other important phosphates are tributyl phosphate, triethyl phosphate, and Monsanto's Santicizers 140 (cresyl diphenyl phosphate) and 141 (octyl diphenyl phosphate). Neither triethyl nor tributyl phosphate are used for vinyls. Triethyl phosphate is one of the plasticizers used to impart flame resistance to cellulose acetate. It is probable that some of the phosphate esters used for vinyls are grouped under the "all other cyclic plasticizers." Santicizers 140 and 141 are valuable flameproofing plasticizers for general vinyl resin use. One of them is advertised as a non-toxic plasticizer.

Sebacic acid esters are well known to the plastics industry, but the one mentioned at this point in Table II, dibutyl sebacate, is used largely in cellulose acetate butyrate. It is too volatile for general use in

Cady Exact Micrometers
For Inspecting, Checking, Comparing Thicknesses Of
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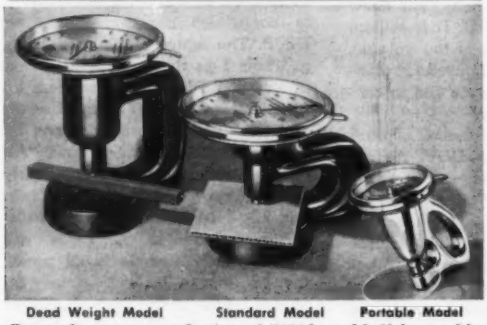

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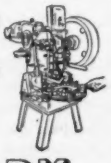

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PX-108	DilsoOctyl Phthalate
PX-138	DiOctyl Phthalate
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PX-404	DiButyl Sebacate
PX-408	DilsoOctyl Sebacate
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most varieties of vinyl chloride formulations.

The stearic acid esters are seldom used with vinyl chlorides. They are intended largely for cutting oil; as a lubricant in such things as wire insulation that must be dragged through apertures; and as mold lubricants for such things as plastics, rubber, and aluminum.

Can't be Segregated

"All other acyclic plasticizers" includes an important and significant number of plasticizers, many of which, as mentioned before, really belong in one of the other categories in Table I, but can't be placed there because publication as such would reveal individual companies' production figures. Most of them are included in the category, "Low Temperature and/or Special Purpose" in Table II.

The largest groups involved here are the ricinoleates, octyl sebacates, and octyl agelates. The ricinoleates, derived from castor oil, are used for blending to impart a soft "feel."

The dioctyl sebacates (also fundamentally derived from castor oil) are another large volume material in this category and are used for low temperature flex and hand for upholstery, garden hose, and wire coating. There has been almost none for other than DO orders since Korea. The other plasticizers in this group are mostly the fatty acid-vegetable oil-based materials as noted in the "Low Temperature or Special Purpose" list shown in Table II, or the special purpose plasticizers which cannot be identified by material because producers do not tell what is used in them. Their use increases steadily as processors learn how to blend them to improve the properties of finished goods.

Improved Formulations

Processors seek constantly to improve vinyl chloride formulations by the use of plasticizers that won't migrate; won't mar other surfaces; will give low temperature flexibility; will give good hand or feel to the finished product; will provide flame resistance; and are non-toxic. Different blends are used for different products. Garden hose, film, and wire coating, for example, all might use a certain portion of DOP or DIOP, but the balance of the plasticizer content might be different in each case. Much depends on cost. There may be several plasticizers intended for the same purpose, each of which gives a slightly different performance; if the processor wants highest performance and can collect profit for that performance he can pay more for the plasticizer. Thus the adipates, azelaics, and sebacates are used for almost the same purposes, but they range from 45 to 67¢ a pound in price. Consequently, a processor must be sure that he can show superiority in his products before he can use costlier plasticizers.

Attention should be called to the omission of polyester- and petroleum-derived plasticizers in this Tariff Commission report reproduced as Table I. The polyester types are used for both primary and secondary plasticizers—are noted particularly for their non-migratory characteristics—are particularly applicable for upholstery and wire coating. The petroleum derived materials are used as both plasticizer and extender—are low in cost—are used largely in wire coating, floor covering, and other uses where filler content of formulation is high.

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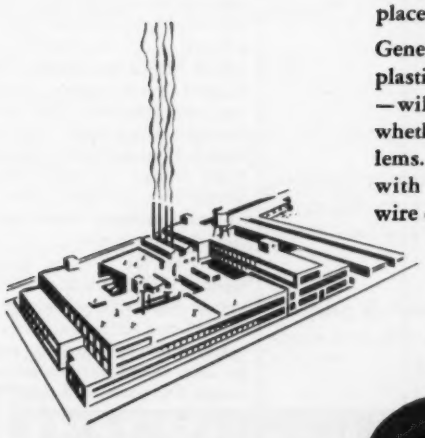

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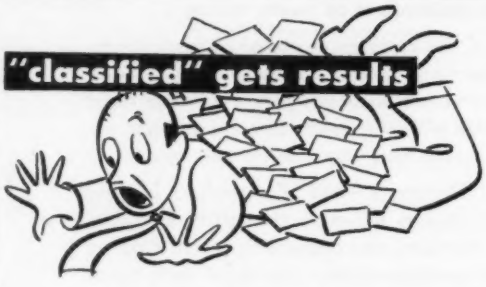

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MODERN PLASTICS

575 Madison Avenue New York 22, N. Y.

Laminates

(*Continued from pp.* 129-140)

attached dome-shaped inset ends. The radius of curvature of the domed ends could be made that of the cylindrical section to eliminate almost completely any knuckle stresses. Interior sealing could be effected by form fitting liners fused externally to dry glass fiber, which could in turn be bonded to the tank interior; metal plating techniques are also feasible. Conduits could be molded integrally and faired into the inner surface of the cylinder to facilitate liner installation. Connections with adjacent ship sections would be effected with flush fittings to preserve the general smoothness presented by the laminate exterior A ⅛- to ½-in. laminate thickness should be adequate to contain 500 p.s.i. internal pressure. As mentioned previously the stabilized production cost of such a tank has been estimated at approximately 25% of the cost of the welded stainless steel tank.

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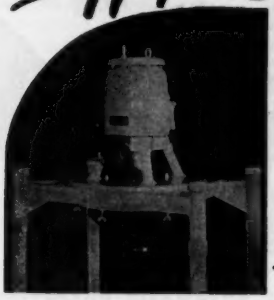
The author wishes to express his appreciation to P. Robert Young and J. Howard Powell of Fairchild Guided Missiles Div. for their help in preparing this paper.—END

NEW *High Speed* MIXER



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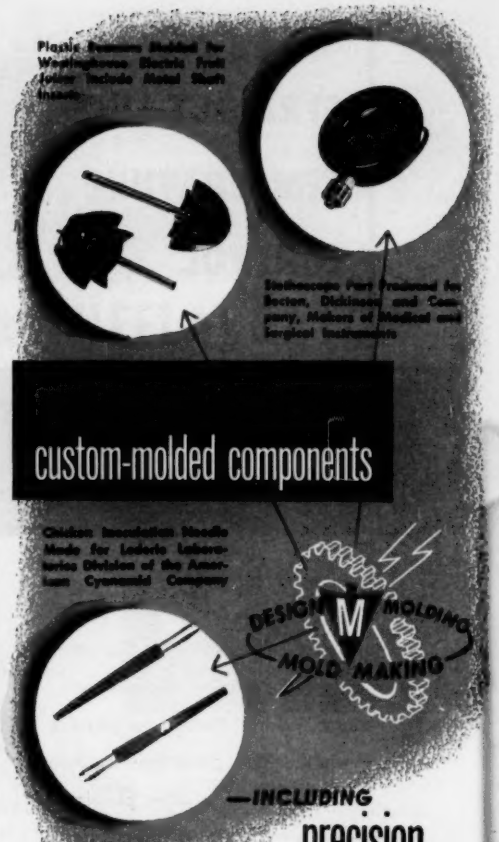

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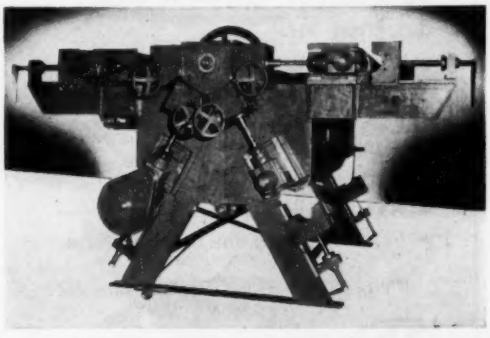

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Manufacturers of Printing Presses and Cylinders

Thickness

(*Continued from pp. 141-6*)

responding change in activity (measured in discharges per second) is greater than the background noise level.

Applications

The more obvious applications of beta radiation lie in continuous nondestructive measurements of thickness of a wide range of materials, such as plastics films (cellulosics and vinyls), sheet plastics (up to approximately ¼ in. thick), metal foils and metal-coated plastics, textile fabrics and coated fabrics, and paper, paperboard, and coated papers.

As pointed out earlier, these devices discriminate the mass only and do not take into account the chemical identity of materials. The method is also applicable to combinations of material, such as may be entailed by wax coatings on paper, organic films on textiles, or metal-plated plastic sheets. Better and more rapid inspection can be achieved through radiation detectors than by other methods.

The writer has also found the techniques useful for inspection of reinforced plastic sheets, entailing a random distribution of glass fibers and polyester resins. This is the most effective way for non-destructive inspection of such combinations, permitting easy recognition of porosity or maldistribution of the filler and the resin. However, if the densities of the filler and the resin are too close to one another, the discrimination would not be as marked.

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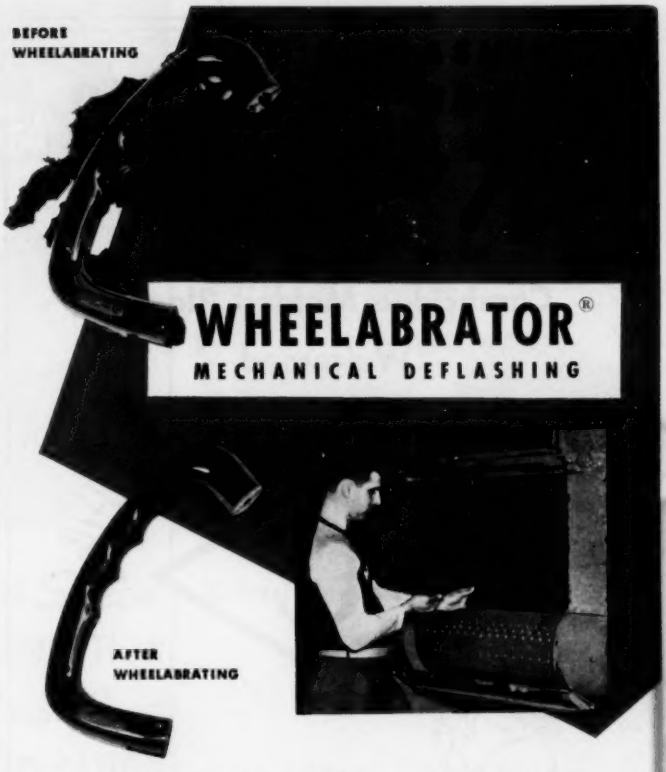
In the beta emitter and thickness gage appear one of the first successful industrial uses of radioactive isotopes, presaging an ever-growing activity in many industries. As plastics engineers become more familiar with the many useful properties of radioactive isotopes, new and significant industrial applications of use to the industry will begin to make their appearance.—END



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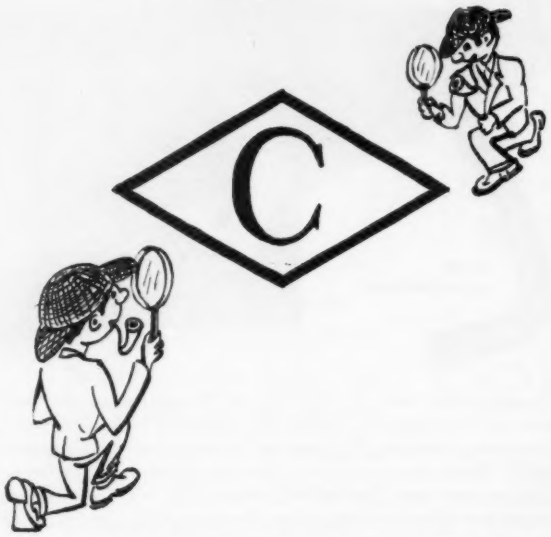

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946, of MODERN PLASTICS, published monthly at Bristol, Connecticut, for October 1, 1951.

State of New York
County of Queens ss.

Before me, Notary Public in and for the State and county aforesaid, personally appeared Charles A. Breskin, who, having been duly sworn according to law, deposes and says that he is the Publisher of the MODERN PLASTICS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), to wit:

1. The names and addresses of the publisher, editor, managing editor, and general manager are:

Publisher, Charles A. Breskin, 575 Madison Ave., New York City.

Editor, Hiram McCann, 575 Madison Ave., New York City.

Managing editor, A. Paul Peck, 575 Madison Ave., New York City.

General manager, A. S. Cole, 575 Madison Ave., New York City.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as those of each individual member, must be given.)

Modern Plastics, Inc., 575 Madison Ave., New York, N. Y.

Charles A. Breskin, 575 Madison Ave., New York, N. Y.

Mrs. Charles A. Breskin, 55 Park Road, Scarsdale, N. Y.

Linda S. Breskin, 55 Park Road, Scarsdale, N. Y.

Theodore B. Breskin, 540 Tuckahoe Road, Yonkers, N. Y.

S. Moisseiff, 55 Liberty St., New York, N. Y.

E. S. Gregg, 111–8th Ave., New York, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding one. percent or more total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

CHARLES A. BRESKIN, Publisher

Sworn to and subscribed before me this 18th day of September 1951.

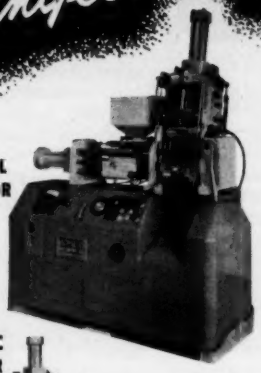
[SEAL] NORMAN B. SMITH, JR.

Notary Public, State of New York No. 41-3740250. Qualified in Queens County. Certificates filed in the following offices: County Clerk, New York; Register, New York & Queens Counties.

Commission expires March 30, 1953

MOSLO *Minijectors*

MOSLO UNIVERSAL MINIJECTOR



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High Speed PRODUCTION *Low Cost* OPERATION

Want *volume* injection molding with low die expense? Then investigate these small high-speed Moslo Minijectors—which in hundreds of cases are out-performing larger machines in turning out small molded pieces or parts. Every Minijector is built for lasting service and will provide economical, efficient, automatic operation.

MOSLO DUPLIMATIC MINIJECTOR—especially for insert molding of cord-plugs, switch parts, etc. A two-sided self-positioning lower mold section allows operator to remove finished molded part from the mold section and refill with new inserts while the other mold section is in cycle. Automatic hydraulic operation provides for complete operator safety. Mold casting area 40 square inches. Injection pressure 20,000 p.s.i. Injection capacity to 4 oz.

MOSLO UNIVERSAL MINIJECTOR—A versatile, high-speed molding machine of up to 4 oz. capacity. Universal mold-clamp assembly readily accessible to operator allows mold to be changed in minimum time. Fully automatic hydraulic operation. Injection pressure 16,250 to 20,000 lbs. p.s.i. Casting area 30 to 60 square inches.

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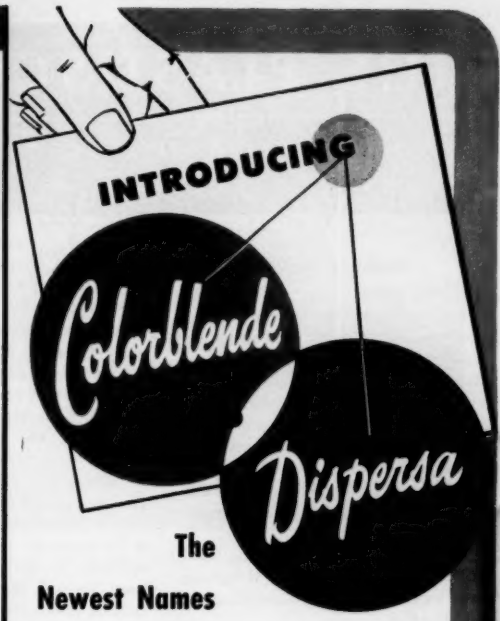

The Newest Names In Dry Colorants

Mid-America Plastics, Inc., is operating its Dry Color Division under full production. A completely equipped laboratory and modern manufacturing facilities formulate and compound "Colorblende" the dry colorant, and "Dispersa" the wetting agent. You can get immediate delivery of "Colorblende" in 17 Bureau of Standards colors or specify any special colors.

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Plastics for the QMC

THE following are only a few of the plastics experimental applications that are now being worked on by the U. S. Army Quartermaster Corps. Extruded vinyl strips may be developed to replace or extend cotton webbing used for strapping or belts. The extruded strip is processed with a texturized surface so that insofar as looks go, it resembles regular OD strapping or belting and has equal strength or "give."

Vinyl-coated cotton is being tried instead of duck for such things as brief cases, map cases, dispatch cases, and the like.

Among the most promising of all new developments is a high styrene--rubber compound from which cap visors are being compression molded. The present leather visors are two pieces laminated with cardboard and have to be stitched. If the present experiment works out successfully, plastic cap visors will be produced at one third the cost of leather; will be produced from less critical material than leather; and will have no tendency to crack.

In addition to its possibilities as a food wrapper either alone or in laminates, and as a wrapper for machine guns, saran is receiving widespread attention. Among other things it has been mentioned as a batting for clothing and sleeping mats.

Saran Soles—Further development in the use of saran as an inner shoe sole is expected to bring good results. In World War II saran inner soles were used primarily in jungle warfare because of their imperviousness to moisture, but now they are being developed in a little different form for cold weather use. Saran inner soles are desired because they absorb less moisture than felt which is presently used. Wet felt freezes.

Various types of combinations are being tried, one of which is a complete sole woven in one piece from saran monofilament. Another has an inner layer woven like a radio grille with a saran screen-type weave on the inner and outer surfaces. Another type is simply composed of five or seven layers sealed together; still another is a saran honeycomb sandwich. The big problem seems to be the development of a satisfactory edge seal; the customary type of sealing tends to "thin out" the material along the edges so that it has a tendency to break.

A further prospective use for saran is for mosquito bar to replace nylon netting. The same material might be used for tent flies over kitchens in combat areas.

Standard Pyroxyloid Corp., Leominster, Mass., has received a large contract for production of plastic tray liners which are expendable linings for food trays used in hospitals, trains, and so forth. The contract was let by the Chicago QMC office. It is reported that Standard Pyroxyloid is using a heat vacuum molding machine supplied by Industrial Radiant Heat Corp., 51 Madison Ave., New York, N. Y., on its production line and has been able to make a sizeable reduction in cost through this method.

Plastics for Closures

MORE than 14 million lb. of plastics had been used for closures in the January-June 1951, period, in comparison with 10,200,000 lb. used in the same period of 1950. June 1951, consumption was 2,200,000 lb. in comparison with 2,350,000 lb. in May.

Imported Raw Materials

THE importance of imported benzene, naphthalene, and other coal tar derived products from Europe, has been emphasized over and over again. In the first four months of this year, they came in in great quantity—as much as 7 million gal. of benzene in one month and 10 million lb. of naphthalene. The May figure, the latest available from the Census Dept., reports that only 764,000 gal. of benzene were imported into the United States in that month and only 4 million lb. of naphthalene.

Missing from the May naphthalene import was any quantity from Czechoslovakia, from which this country had been receiving naphthalene at rates as high as 1 million lb. a month or more. The largest quantity of naphthalene from any one country in May was 2,221,000 lb. from Germany.

It has been reported that the Czechs, in exchange for part of their naphthalene, wanted chemicals used in the preparation of drugs used to prevent soldiers on duty from going to sleep!

Capryl Alcohol

PRICES of capryl alcohol in tank car lots have been lowered to 19½¢ per lb., in comparison with the former 28½¢, per lb. by Rohm & Haas Co. Capryl alcohol is currently used as an intermediate for vinyl plasticizers and urea-type coating resins.

Expanded Research Facilities

PLANS have been announced by Heyden Chemical Corp. for construction of a series of new laboratory units at its Chemical Research Div., Garfield, N.J., which will increase research facilities by 30 percent. The first unit, now under construction, is scheduled for completion in the last quarter of 1951. An extensive program planned for the new facilities is the development of new applications of Pentek and other pentaerythritol derivatives which are used as a base for quick-drying, weather-resistant paints, varnishes, resins, and lacquers specified for navy ships, army tanks, and other defense uses.

From Shoes to Luggage

AN elastomer resin blend, Neolite, which has been used for shoe soles and heels since 1944, was introduced to the leather goods trade at the Luggage Show in New York in August. The material can be made to look like leather, is as flexible as leather, and can be fabricated in the same manner and on the same machines now used by manufacturers of leather goods. It is waterproof and, it is claimed, resists wear better than leather and will not crack or dry out. Goodyear Tire & Rubber Co. is currently

* Reg. U. S. Pat. Office.

Overall View showing new facilities . . . Ethylene Plant, Ethanol Plant and Isopropanol Plant

THE GIANT *of* GRANGEMOUTH

The British Petroleum Chemicals Ltd. plant at Grangemouth, Scotland, will supply the British Isles with a diversified line of important industrial chemicals and chemical intermediates derived from a crude petroleum stock. It was designed by Stone & Webster Engineering Corporation and built under the supervision of E. B. Badger & Sons Co. (Great Britain) Ltd.

STONE & WEBSTER ENGINEERING CORPORATION

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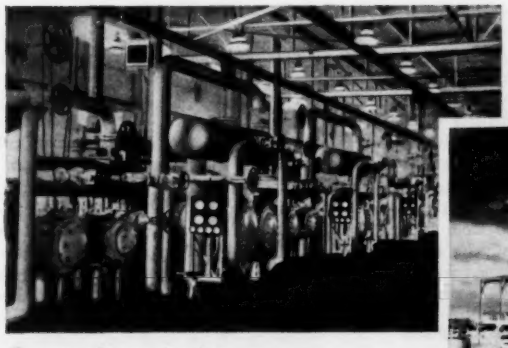


Compressor House — Interior

ETHYLENE PLANT
Cracking and Fractionating Structures

PLASTISCOPE

manufacturing Neolite in sheet form in various thicknesses and sizes, and is planning to turn out continuous strips up to 72 in. in width in the near future.

Fluorinate Film

DETAILS on the use of Teflon resin in a water dispersion for use as either molding or extrusion material have recently been released by Du Pont.

These aqueous colloidal dispersions were announced in November 1949. It is claimed that films cast from these dispersions can be made as thin as 0.25 thousandths in. and are expected to find application for various insulation purposes where mica is now used, particularly in the development of new and more compact radar equipment. Glass fabrics coated or impregnated with Teflon are also expected to find numerous uses in the insulation field.

The preparation of homogeneous films from dispersions of Teflon involves four distinct steps: 1) casting on a flat metal surface; 2) drying to remove the water; 3) baking at temperatures above 327° C.; and 4) cooling the baked films.

Cracks may occur during the third, or baking, stage of the process, if coatings are cast having a thickness greater than 1.5 thousandths inch. Thus, in the preparation of thicker films, multiple coatings must be used, each separately baked.

Upon completion of the baking cycle, the film is either cooled rapidly by quenching with water, which serves to impart a maximum toughness, or cooled slowly to room temperature, which gives a film that is more easily wetted by succeeding castings. The process for coating or impregnating fabrics is similar to that for film casting.

Rapid stirring of unstabilized Teflon dispersions results in coagulation of the dispersed particles which, when mixed with certain lubricants, form a paste which may be extruded at ordinary temperatures. The lubricated compositions may be readily shaped in a ram-type extruder, and continuous processes have been developed for making tapes and for coating wire with this coagulated Teflon. By passing through a pair of rolls, the thickness of the tapes has undergone a reduction from 0.02 to 0.001 inch.

Wire or other metallic conductors can be coated with this lubricated polymer in about the same method as that used for the preparation of tapes, and is at present suited for applying insulation with wall thicknesses of from 0.005 to 0.075 in. at speeds up to 50 ft. per minute.

Blowing Agent for Foam

IT HAS been claimed that one of the reasons for the slow development of so-called foam or sponge plastics, particularly vinyls, has been the failure to develop a satisfactory foaming or blowing agent. Naugatuck Chemical Div., U.S. Rubber Co., Naugatuck, Conn., now claims to have found the answer to this problem in a product called Celogen, a blowing agent for cellular or open pore sponge products made from either rubber or plastics.

Celogen is a stable, white powder at normal temperatures, but decomposes on heating at temperatures above 135° C. with liberation of nitrogen and formation of a polymeric, odorless residue. It liberates nitrogen by an internal oxidation-reduction reaction. It is non-staining and non-discoloring. Both Celogen and its decomposition products are reported to be non-toxic. It is suggested for use in the manufacture of non-discoloring, non-staining, and odorless expanded rubber and plastics products with fine uniform cell structure. It makes possible the production of odorless, flame-proof, buoyant, oil-resistant vinyl sponge in bright colors which has a structure from rigid to soft, and requires only light material for the mold—that is, no heavy steel mold would be necessary.

Styrene Expansion

THE Long Beach, Calif., plant for production of styrene by Monsanto Chemical Co. has doubled its capacity just one year after the unit was first opened. The program was part of Monsanto's $22 million plastics expansion program. The plant was initially dedicated Aug. 15, 1950. Irving C. Smith, general manager of the company's Western division, pointed out that the government's synthetic rubber program, requiring large amounts of styrene monomer, was still a factor controlling the supply of raw materials necessary for full operation of the additional plant facilities.

Vinyl Stabilizer

DEVELOPED by National Lead Co.'s Chemicals Div. and known as Dutch Boy CS-137, a new barium-sodium stabilizer for transparent vinyl plastics is used for applications which require exceptional light stability, such as raincoats, upholstery, drapes, and shower curtains. Its resistance to light exposure is indicated by the fact that 6000 hr. in a Weather-Ometer produced substantially no change in a formulation tested, while conventional formulations are said to usually fail in less than 1000 hours.

Expanded Research Facilities

CONSTRUCTION on a new wing of Princeton University's Plastics Laboratory has recently been completed. The new wing, which increases the facilities by 50 per cent, includes two additional chemical laboratories which are to be used for expanded polymer research involving the study of polyurethane resins and high and low dielectric constant materials for signal equipment.

Big Bottles

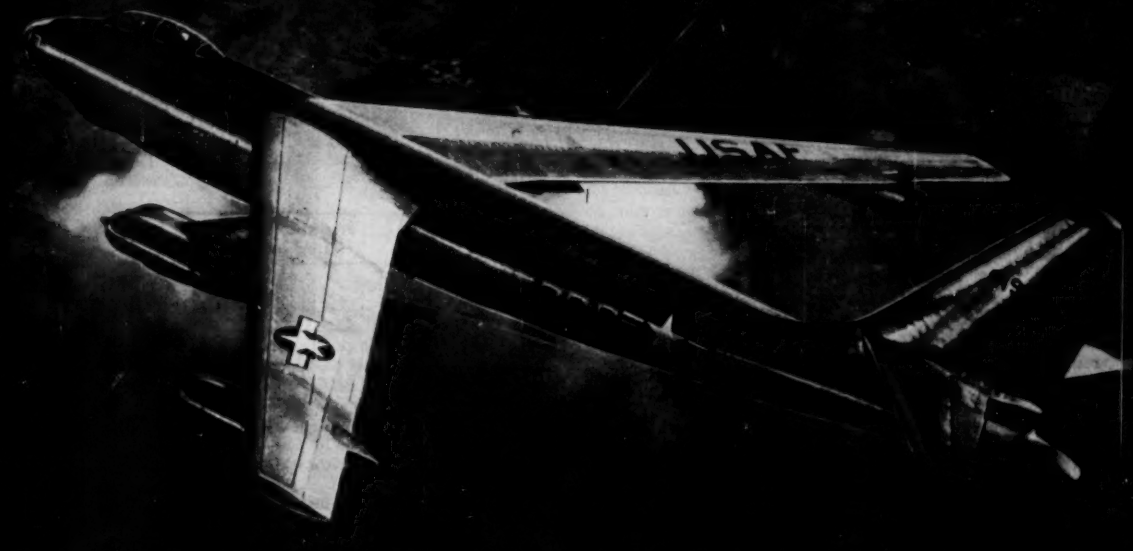
POLYETHYLENE bottles of 1- and 2-gal. capacity have been announced by Plax Corp., Hartford, Conn. Blow-molded in one piece, the bottles are designed for shipping liquids in bulk form, such as acids, chemicals, pharmaceuticals, and food and syrup concentrates.

Resorcin-Phenol Adhesive

MILITARY specification MIL-A-379a is met by a low-cost resorcin-phenol adhesive developed by Borden Co.'s Chemical Division. Called Casophen LT-68, the new adhesive is an improved modification of Casophen LT-67 in that it can be stored for a year without sacrifice of its working properties. LT-67 had a storage life of only six weeks.

The new glue will enable manu-

VISIBILITY



by Swedlow

The BOEING B-47 stratojet is the fastest known bomber in the world. This great six-jet engine powered, swept-wing bomber will be produced in quantity for the U.S. Air Force by Boeing Airplane Company, Wichita, Kansas, the Douglas Aircraft Co., Tulsa, Oklahoma and the Lockheed Aircraft Corp., Marietta, Georgia.

Transparent laminated canopies and all-nylon fuel cell backing (in accordance with Boeing specification BMS-8-13) are SWEDLOW's contributions to the admirable functional efficiency of this superb fighting machine.

SWEDLOW was selected as a major supplier of these important factors because of SWEDLOW's unique reputation and more than a decade of experience in the development and fabrication of vital parts for the aircraft industry.

● ***We shall be glad to assign our staff engineers to work with you in solving problems in all phases of plastic fabrication.***

PLASTISCOPE

facturers of defense materials to stretch scarce resorcin supplies because it contains less than 20% of this ingredient. It is lower in cost than any other resin-phenol glue that meets the above specification.

Resistant to boiling and outdoor exposures, LT-68 is used in laminated frames, keels, and other ship parts, and for ribs for Arctic shelters, field furniture, and skis.

New Chemical Plant

PLANS for constructing a new chemical plant at Calvert City, Ky., have been announced by B. F. Goodrich Chemical Co. The plant, situated on a 175-acre tract, will represent an investment of more than $5 million upon its expected completion in late 1952. First material to be produced in the new plant will be vinyl chloride monomer to be shipped in bulk to the company's plant in Avon Lake, Ohio, and to supplement supplies made at Louisville, Ky. This monomer is used in the firm's line of Geon resins.

Compendium on Inhibitors

NEW information on inhibitors, whether derived from laboratory research or from field experience, is being collected by Technical Practices Committee 9 on Corrosion Inhibitors, one of the technical committees of the National Association of Corrosion Engineers. Contributions ranging in size from one-page observations to complete papers are being received by Aaron Wachter, Shell Development Co., Emeryville, Calif. Papers will be discussed critically by the committee and then issued in collected form accompanied by discussion.

Furane Polymer for Coatings

DEVELOPMENT of a new furane resin polymer has been announced by Furane Plastics, Inc., Glendale, Calif., for application as a chemically resistive coating. The coating, known as Resistojet, may be applied by brush, dip, or spray techniques and cured at room temperature. Film formation takes place by catalytic action, as the furane polymers tranform into a hard, impervious, strongly adhering coating. Although only low temperatures are required for its cure, Resistojet has excellent heat resistance. It is recommended particularly for protection against strong non-oxidizing acids, alkalies, and solvents.

Research Unit Completed

COMPLETION of the first major unit of its new central research laboratories at Neville Island, Pa., has been anounced by Pittsburgh Coke & Chemical Co. The new unit, which more than doubles the company's available laboratory space and centralizes a number of research groups, was designed to take care of the research needs of the company's new fine chemical division, particularly in the field of synthetic organic chemicals.

Development for Sealed Insulation

A NEW fibrous insulating material has been developed that will not blister when covered with the hot compounds used for hermetically sealing electrical components. Produced by Rogers Corp., Manchester, Conn., the first application of the new material, Duroid 705, was in fluorescent ballasts where the insulating material was covered with asphalt heated to 225° C. The improved insulation permitted the manufacturer to use a single insulating part instead of the two-piece assembly previously employed.

A Different Copolymer

A COPOLYMER called Cast Optics No. 3 (CO-3), consisting of CR-39 and methyl methacrylate, has been developed by Cast Optics Corp., 1 Post Rd., Riverside, Conn. One of the problems encountered when using CR-39 has always been difficulty in forming, but this new copolymer now has approximately three-fourths the formability of methacrylate.

Outstanding features of CO-3 are its high tensile, flexural, and compressive strengths and its resistance to solvents and crazing. It can also be hot formed to quite radical curves and sharp corners. CR-39 has always been noted for its hardness, optical clarity, and resistance to crazing or scratching. Thus, the new CO-3 fills in a niche between methyl methacrylate and CR-39 in that it has a surface that will stand up under severe abrasion which it inherits from CR-39, and easier formability which it inherits from methacrylate.

The material sells in a wide range of from 83¢ a lb. for large quantities of thin sheet to $2.65 a lb. for small orders of thick sheet. Thickness ranges from 0.030 to 0.025 inch. Properties are shown in the accompanying table.

In addition to production of the new material, Cast Optics Corp. has enlarged its facilities for production of CR-39 cast sheet and now has a capacity of 1920 sq. ft. per day. One of the outstanding applications for the sheet stock has been its use as the complete covering for an outdoor swimming pool built by Bulova. It is also being used as a welding cover plate lens for electric and gas welding helmets. Last month's sales for this particular use exceeded 100,000 units. U.S. Steel, Pennsylvania Railroad, and other firms have standardized upon this lens. Its resistance to pitting compared with glass is demonstrated by its minimum life of 1000 welding hours. Glass will last from 5 min. to 24 hr. depending upon whether it is overhead or horizontal welding.

Manufacturers of precision instruments are also finding increasing applications for CR-39 as instrument windows. Other uses include curved safety lenses, and photo-

Properties of CO-3 and Methyl Methacrylate

Property	*CO-3*	*Methyl methacrylate*
Specific gravity, 25° C.	1.23	1.18
Hardness, Rockwell	M101	M106
Tensile strength, p.s.i.	8700	7900
Flexural strength, p.s.i.	14,700	13,900
Modulus 10^5 p.s.i.	3.3	3.5
Compressive strength, p.s.i.	37,000	17,900
Modulus 10^5 p.s.i.	3.3	3.2
Impact strength ft.-lb./in.		
Notched Izod	0.3	0.4
Unnotched Izod	5.7	5.3
Abrasion resistance		
Falling emery, times methacrylate	3	1

let's LOOK at the shape of things to come

... if future plans require it

HERE'S HOW YOUR CUSTOMERS CAN CUT COSTS WITH FEWER FINISHING OPERATIONS..

Your customers can keep their product finishing steps to a minimum with plastics! And, particularly with the leading plastic . . . *polystyrene,* because, among other advantages, it comes in a wide range of built-in colors . . . colors that won't chip, peel or rust. With built-in color, they can reduce finishing operations.

Also, your customers can turn out more units per day with *larger area moldings* of polystyrene that have been developed through rapid advances in polystyrene research, in molding techniques and machinery. By using these new moldings in their products, they save valuable production time by reducing the number of assembly operations.

Dow, as a leader in the plastics industry, offers you and your customers a complete line of *quality controlled* polystyrene plastics under the registered trade-mark Styron, plus the expert assistance of Dow's Plastics Technical Service. When looking at the shape of things to come this year, be sure to include Styron in your planning for future civilian or defense products. Write Dow today.

Plastics Division—Dept. PL-115

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DOW plastics

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graphic filters and sun glass lenses are also in production. Military uses include water-resistant watch crystals and gas mask lenses. It is claimed that the latter have been approved as an alternative material for laminated safety glass gas mask lenses, and both the optics and the price of CR-39 lenses are claimed to be better than those of glass.

Cast Optics Corp. is also proceeding with its production of cast styrene sheet which is being used in a number of undisclosed applications.

Defense Production Pools

PLASTICS processors will be interested in a new plan announced by the Defense Production Administration to pool production facilities and know-how in order to obtain defense contracts.

Further details on how to form these defense production pools are contained in a booklet issued by the Defense Production Administration. It can be obtained from Dept. of Commerce Field Offices and from the Distribution Section, Printing Services Div., Dept. of Commerce, Washington 25, D.C.

The booklet explains in detail the various types of production pools it is possible to form and gives the characteristics of an ideal pool. The disadvantages of pool operations, as well as the advantages, are explained, and the attitude of the government toward pools is given.

Polymer Adhesives

METALS, ceramics, and glass can be adhered to themselves as well as to other materials such as wood, cloth, synthetic rubber, and paper by a new class of adhesives called Pylene, developed by Polymer Industries, Inc., Astoria, N.Y. Some grades of Pylene resins can be converted to very hard, tough plastics without the use of heat, while other grades can be polymerized only by heat. They are available as powders, pre-polymer liquids, and as solvent solutions.

In addition to their bonding properties, Pylene resins are resistant to solvents, chemicals, abrasion, and heat and moisture, and have great affinity to the adhered surfaces. The bonds made with these resins have high electrical resistance, dielectric strength, and volume resistivity.

Slogan Contest

CASH awards of $500, $200, and $100 are being offered for the most effective slogan submitted for the Fifth National Plastics Exposition sponsored by The Society of the Plastics Industry to be held March 11-14, 1952, in Convention Hall, Philadelphia. Any person connected with the plastics industry, its suppliers, or its customers is eligible to compete.

Entry blanks which are being circulated to 400 companies in the plastics industry can be secured from Slogan Contest Committee, Fifth National Plastics Exposition, 67 W. 44th St., New York 18, N.Y.

Plant Increases Production

AFTER a year of limited manufacturing of vinyl dry goods films, The General Tire & Rubber Co.'s plastic plant at Jeannette, Pa., is undergoing an extensive program to expedite full-scale production. The trade name Luxon has been chosen to cover the firm's vinyl products.

Among Luxon materials slated for greater production is a semi-rigid, transparent vinyl currently being produced for government orders. The production of rigid vinyls—both transparent and colored—for industrial uses will soon be ready for marketing, together with artificial leather-type vinyls. Basic laboratory work has also been completed on the firm's vinyl-type packaging film, with production expected to start in September.

Styrenated Oils

THE possibility that styrene monomer will be more available in 1952 calls attention to the fact that greater and greater quantities are being absorbed by the paint industry. The most glamorous and publicized of these paints have been the so-called water- or rubber-base paints. However, just as much or more development work has been done on styrenated alkyds—the styrene content of these alkyds is usually 40 to 50% of the total vehicle solids. Among other uses, they are widely used for coating shells and other ammunition.

Reports indicate that in Europe these styrenated oils are being used much more extensively for maintenance and ship paints. One of the steamship companies for South America has been applying styrenated oil primers (red lead) and top coatings (lead titanate) when painting the outside hulls of a dozen 10,000-ton Liberty-type ships with good results after three years.

Several chemical industries in Europe also use styrenated oil paints because of easy application, rapid drying, and relatively high chemical resistance. Especially good results are obtained when paints are pigmented with aluminum.

FINANCIAL

American Cyanamid Co. reports that sales of approximately $201 million for the six months ending June 30, 1951, were 39% higher than those of the first half of 1950. Consolidated earnings for the first half of 1951 amounted to $22,690,449 in comparison with $12,468,785 for the same period last year.

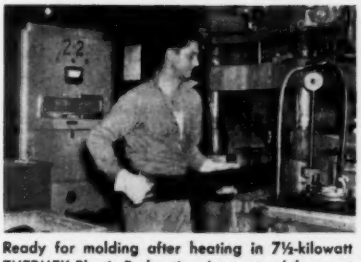
Celanese Corp. of America reported sales for the first six months of 1951 of $125,513,046 compared with $105,612,621 for the same period in 1950. Net income before taxes was $38,397,886 for the first half of this year, as against $34,939,284 in the corresponding period of 1950, but because federal taxes were higher in 1951 than in 1950, total net income for the first half of 1951 amounted to $16,667,886 compared with $20,045,284 for the first half of 1950.

COMPANY NOTES

The Atlas Mineral Products Co. has announced the appointment of **Edison C. Sickman** as general sales manager; **Donald F. Deakin** and **Gerald F. Gilbert, Jr.,** are his assistants. **Earl A. Erich** has been named to handle technical service activities.

Michigan Molded Plastics, Inc., has announced the election of **R. C. Bedell** as vice president in charge of engineering. **Charles T. Wiedman** succeeds him as chief engineer.

Loma Plastics, Inc., 1111 Foch St.,



Ready for molding after heating in 7½-kilowatt THERMEX Plastic Preheating Apparatus (above, at left), preforms are placed in press. Uniform plasticity produces solid, homogeneous castings and reduces pressure requirements, lengthening mold life.

Amount of shrinkage can be predetermined, thus simplified dies can be used. 150-ton press molds four units at a time.

cuts scrap loss 75%

THE MANUFACTURER of these plastic handles for electric irons now heats preforms electronically with THERMEX Plastic Preheating Apparatus. Results: Scrap loss due to hollow sections or broken pins has been cut 75%. Product is stronger, has better finish.

Preheating time has been cut, too. With former equipment, preheating took twice as long, yet was not as effective.

THERMEX Plastic Preheating Apparatus produces uniform heating throughout the preform. In this installation, improved plasticity reduces ram pressure required by 25%. Thus life of expensive molds is conserved and press maintenance is reduced. Predetermined shrinkage permits use of simplified dies, and minimizes waste of material in flash cut-off.

As the first step in improving your plastics molding why not let one of our experienced Thermex Engineers survey your operations and make suggestions? There is no obligation. Write The Girdler Corporation, Thermex Division, Louisville 1, Ky.

THERMEX—T. M. Reg. U. S. Pat. Off.

THE GIRDLER CORPORATION
Thermex Division

PLASTISCOPE

Fort Worth 7, Texas, has bought the compression and injection molding plant of **Indian Nation Plastics**, Oklahoma City. The purchase includes one 4-oz. injection molding machine, five 200-ton compression and transfer presses, two 75-ton transfer presses, and a number of 50-ton compression presses.

British-American Carbon Corp. 18 E. 48th St., New York, N.Y., has been formed to manufacture and sell a wide range of carbon and graphite products used in the chemical, metallurgical, and process industries. The new company is jointly owned by **Great Lakes Carbon Corp.** of New York and **Powell Duffryn Carbon Products Ltd.**, England.

Tennessee Eastman Co. has expanded its Lodi, N.J., distribution center to handle virtually all of the company's line of industrial chemicals and dyestuffs.

The Dynakon Corp., 5509 Hough Ave., Cleveland, Ohio, molder and laminator of high-strength glass fiber reinforced plastics, has appointed **Burton Field** plant manager and **William Schwartz** chief chemist for the company.

Flexible Tubing Corp., Guilford, Conn., has announced the appointment of **Leo Martin** as machine design engineer and **James W. Hull** as chief of the **Chemical Laboratory and Development Section.**

U. S. Equipment Corp., manufacturer of plastics products, has moved its production and warehouse facilities to Macedon, N.Y.

Groov-Pin Corp. has moved into its new plant and general offices at 1119 Hendricks Causeway, Ridgefield, N.J.

Firestone Plastics Co. has opened a southern district sales office in High Point, N.C., to handle sales of Velon upholstery sheetings. **Norman C. Weisbecker** is in charge of the new office.

Battelle Memorial Institute, world's largest independent industrial research foundation, has announced its plan to establish a European branch, the location of which is as yet undecided.

Pittsburgh Coke & Chemical Co., producer of plasticizers and basic chemicals, has announced the formation of a new Fine Chemicals Div. with **Dr. L. D. Barrick** as manager and **R. M. Locke** assistant manager. The anticipated manufacturing program includes a selected range of dyestuffs, pigments and intermediate products, pharmaceutical intermediates, and other chemicals.

Dow Corning Corp. has moved to new offices at 600 Fifth Ave., New York, N.Y.

The Estes Co., Inc., has moved to a new location at 247 Park Ave., New York, N.Y.

Kurz-Kasch, Inc., has announced the following personnel appointments. **Walter G. Davidson** was elected president, succeeding **Joseph J. Bauman** who recently died. **Victor G. Reiling** has been elected vice president in charge of manufacturing; **Robert L. Davidson** was elected vice president in charge of sales.

Elmer C. Maywald & Co., Inc., 189 W. Madison St., Chicago, Ill., has been appointed sales representative for pressure-cast beryllium copper cavities and cores in the Chicago area for **General Mold Casting Corp.**

General Electric Co.'s Chemical Dept. has announced the appointment of **Louis S. Gleason** as superintendent of the plastics molding plant at Decatur, Ill. **Alfred R. LaCasse** has been named general foreman of the alkyd resin plant at Schenectady, N.Y.

The B. F. Goodrich Co. has named **Robert Price** sales manager of the **Plastic Products Division. Ira Needles** has been elected president of **The B. F. Goodrich Co. of Canada, Ltd.**

Monsanto Chemical Co. has announced the appointment of **John J. Healy, Jr.**, as assistant to the vice president in charge of research, development, and patent activities. **Robert M. Aude** has been named production superintendent of the new **Plastics Div.** plant in Addyston, Ohio.

United States Rubber Co. has announced the retirement of **Herbert E. Smith**, chairman and chief executive. He is succeeded as chairman of the board of directors by **H. E. Humphreys, Jr. John P. Groesbeck**, has recently joined the firm as a development engineer in the new products division.

The Goodyear Tire & Rubber Co., Films & Flooring Div., has announced the transfer of **Kenneth J. Whisler** to Dallas, Texas. **Jay F. Smith, Jr.**, succeeds him in Philadelphia. **Robert C. Lynes** has been transferred to Detroit, succeeding **William R. Berkinshaw** who goes to the Los Angeles office. **J. B. Post** has also been transferred to Los Angeles. **Gordon W. Cummins** succeeds him in Chicago.

Union Plastics Corp., 50 Broadway, New York, N. Y. has established a new plant at Secaucus, N.J., for the production of extruded tubing, wire coating, solid rods, welting, and luggage binding.

Reichhold Chemicals, Inc., has moved its sales office from Detroit to International Bldg., Rockefeller Center, New York, N. Y., as part of the centralization of the executive offices.

The Kellex Corp., specialist in research and engineering, has changed its name to **Vitro Corp. of America.** The organization, policies, and services will continue as before, and the firm is operating at the same address, 233 Broadway, New York 7, N. Y.

H. Muehlstein & Co., Inc., has moved its **Plastics Div.** to its plant at 4237 W. 42nd Pl., Chicago 23, Ill.

Electric Parts Corp. has moved to 2525 W. Moffat St., Chicago 47, Ill.

PERSONAL

Dr. Edward U. Condon, noted nuclear physicist, has been appointed director of research and development for **Corning Glass Works**, Corning, N. Y.

Edward M. Epstein, who joined **E. I. du Pont de Nemours Co., Inc.**, in 1922, has been named manager of a newly created quality control section of the **Nylon Division.**

Carleton Ellis, Jr., has been ap-

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PLASTISCOPE

pointed director of sales for **Plaskon Div., Libbey-Owens-Ford Glass Co. Whiting N. Shepard** has resigned from that position after having served in the division for 19 years. Mr. Shepard says he has made no definite plans for the future.

Leon L. Bertram has been named assistant manager of the Hopewell, Va., cellulose plant of **Hercules Powder Co., Inc.**

George H. Goecke has been appointed sales engineer for **Industrial Ovens, Inc.**, Cleveland, Ohio.

John E. McKeen, president of **Chas. Pfizer & Co., Inc.,** has been named an honorary member of **The American Institute of Chemists.** Mr. McKeen was cited "for his vigorous and unselfish efforts in the advancement of chemical manufacture to help and heal mankind."

Raymond W. Meyer has been appointed plant superintendent for **Corrulux Corp.,** in charge of all operations at the Houston, Texas, plant.

Robert B. Battersby, formerly of Plastic Manufacturers, Inc., has been appointed to the newly created position of chief engineer of the thermosetting division of **Auburn Button Works, Inc.,** Auburn, N. Y.

Arthur G. Pepler, formerly of Dow Chemical of Canada, Ltd., has been named sales manager of **Rogers Plastic (Canada) Ltd.,** Rawdon, Quebec.

A. H. Borchardt has been elected vice president of **Worthington Pump & Machinery Corp.** in charge of sales of pumping equipment.

George E. Martin has been named to head the technical service division of **Aldan Rubber Co.,** Philadelphia, Pa. He was formerly with the Quartermaster Corps.

A. W. Hanmer, Jr., vice president in charge of molding compound sales for **Durez Plastics & Chemicals, Inc.,** has been appointed a member of the phenol formaldehyde resins and molding powder industry advisory committee by the National Production Authority.

Robert N. Nelson has been appointed assistant sales manager of the pneumatic division for **Sundstrand Machine Tool Co.,** Rockford, Ill.

Edward Rich, formerly with Reiss Associates, has joined **Pioneer Plastics Corp.,** Salem, Mass.

Edward A. Reineck has been appointed assistant sales manager for the chemicals department of **The Quaker Oats Co.** He has been with the company since 1945.

Charles R. Mayer has been named assistant to the president of **Textileather Corp.,** Toledo, Ohio.

William F. Erath has joined the technical and sales staff of **Whittaker, Clark & Daniels, Inc.,** New York, N. Y., manufacturer of minerals, colors, and pigments.

John E. Renner has been named general sales manager for **Lincoln Engineering Co.,** St. Louis, Mo., manufacturer of lubrication equipment and machinery.

W. Ward Jackson, formerly with Celanese Corp., has been appointed general manager of the **Industrial Chemicals Div., Commercial Solvents Corp.**

R. F. Tomlinson has been appointed general sales manager for all divisions of **A. B. Farquhar Co.** He has been with the firm since 1931.

Sherman W. Putnam, formerly assistant general sales manager of The Dow Chemical Co., has joined the staff of **Michigan Chemical Corp.** He will be in charge of commercial development work and will handle special assignments in the expansion program.

Paul Stahlberg has been appointed sales development supervisor of rubber-phenolic molding compounds for the **Chemical Div., General Electric Co.**

Denton Anderson, assistant vice president of **Plax Corp.,** Hartford, Conn., has been named general sales manager. **W. F. Ebling** continues as sales manager.

William R. Haas has been appointed general manager of **Monsanto Chemical Co.'s** new Brazilian affiliate **Monsanto S. A. Produtos Quimicos e Plasticos.** He joined the firm in 1944 and has worked in the **Foreign Department.**

Dr. John B. Davidson has been appointed an associate director of research for **Plaskon Div., Libbey-Owens-Ford Glass Co.** He will supervise research problems pertaining to industrial chemicals, silicones, glues, and industrial resins.

Deceased

Alfred G. York, a director and vice president of **The Watson-Stillman Co.,** Roselle, N. J., died July 22 after a prolonged illness. He joined the company in 1918, and was elected vice president in 1941. In 1945 he was elected to the board of directors, at which time he took full charge of the **Distributor Products Division.** He was a member of the Society of the Plastics Industry and the American Petroleum Institute.

MEETINGS

Oct. 10-11—Society of the Plastics Industry, New England Section Meeting, Equinox House, Manchester, Vt.

Oct. 22—American Standards Association, Annual Meeting; and the Second Annual Meeting of the National Standardization Conference, Waldorf Astoria, New York, N. Y.

Nov. 7-9—American Society of Body Engineers, Annual Technical Convention, Rackham Memorial Bldg., Detroit, Mich.

Nov. 26-Dec. 1—Chemical Industries, 23rd Exposition, Grand Central Palace, New York, N. Y.

Dec. 2-5—American Institute of Chemical Engineers, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

Dec. 13-14—Society of the Plastics Industry, Third Film, Sheeting & Coated Fabrics Div. Conference, Hotel Commodore, New York, N. Y.

Jan. 14-17—Plant Maintenance Show, Convention Hall, Philadelphia, Pa.

Jan. 16-18—Society of Plastics Engineers, Inc., 8th Annual National Technical Conference, Edgewater Beach Hotel, Chicago, Ill.

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FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrel 18"x45", 16"x48", and 15"x 36", 2 roll rubber mills. New 6"x12" Lab. Mixing Mills and Calenders. Other sizes 30" to 60". Royle 2" perfected extruder, and other sizes. 180 ton F. B. Molding Press, 20"x20". Francis 175 tons 24"x18". W. S. 115 ton 24"x 24". Also presses Lab. to 1500 tons from 12"x 12" to 48"x48". Hydr. Oil Pumps, Watson Stillman Hor. 4 plgr. 1¼" & 2½"x4" H & L pressure pump. HPM 10 GPM 2700 lbs. Elmes Hor. 4 Plgr. 5 & 8 GPM 4500 lbs. & 5500 lbs. Hydr. Accumulators, Stokes Automatic Molding Presses, Rotary & Single punch Tablet Machines ½" to 3". Injection Molding Machines 2 oz. to 20 oz. Baker Perkins jacketed mixers 200 & 9 gal. Impregnating units. Ball & Jewell #0 & Leominster #0 Plastic Grinders. Micro Pulverizers. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. Stein Equipment Co., 90 West Street, New York 6, N. Y. Worth 2-5745.

FOR SALE: Thermex Preheater, Model 2P; Electronics Preheater, Model D E; Airtronics Preheater, Model C B. Like new. AARON MACHINERY CO., INC. WOrth 4-8233, 45 Crosby St., New York 12, N. Y.

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FOR SALE: 1 Farrel 16" x 42" Rubber Mill complete with drive and 75 H.P. Motor; 1—French Oil Mill 300 ton self-contained molding press with pushbacks; 1—125 ton Molding Press, 18" x 18". Also Grinders, Extruders, Compression and Injection Molding Presses, Mixers, etc. Send us your inquiries. Consolidated Products Co., 13-14 Park Row, New York 38, New York.

FOR SALE: Injection Presses: 4, 7, 9, 16, oz. HPM, 8, 16 oz. Watson. 2 oz. DeMattia. 22 oz. Lester. 1 oz. VanDorn. Extruders: Lab, 1½" NRM w. crosshead. Complete extruder setup f. Saran Pipe. 1—Lab Banburymixer. Cumberland No 0 and other scrapgrinders. 4—Minkella Infrared Dryers. Compression Presses: 50, 80, 250 tons. 2—Electronic Preheaters. Preformpresses: 1—Stokes R. 1—Kux No 60. 1—Kux No 65 B. 1—Nash Rotary Edger. 2—Embossing Calenders 61" wide. 1—Sheridan Embossing Press.—1—Paterson Stainl. Steel 500 lbs Conical Mixer. Justin Zenner, 823 W. Waveland Ave., Chicago 13, Ill.

FOR SALE: 1—H200 Van Dorn 2 ounce Plastic Moulding Machine. New condition, only moulded 1200 pounds of material. Located at Minneapolis. Reply Box 1196, Modern Plastics.

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2-Oz. DEMATTIA 1947, excellent	$ 1950.
6-Oz. WATSON STILLMAN (1942)	$ 5950.
6-Oz. WATSON STILLMAN (1944)	$ 6750.
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8-Oz. REED PRENTICE, Mod. 10-D ser. #21640	$ 8500.
8-Oz. REED PRENTICE, Mod. 10-D ser. #29500	$10500.
8-Oz. REED PRENTICE, Mod. 10-D, ser. #38220	$11500.
8-Oz. LEOMINSTER, ser. #140 excellent	$ 8500.
9-Oz. H.P.M. Mod. 200-SS, serial #22690	$ 6950.
12-Oz. DEMATTIA, ser. #9-80cl. 1946 good	$ 8500.
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FOR SALE: 1 Stokes No. 280 Single Stroke Tablet Machine with hydraulic overload capacitor and Rieves drive. Price $5,000.00. 4 Buttondex machines at $550.00 ea. Reply Box 1220, Modern Plastics.

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Day & Robinson 100 up to 4000 lbs. Dry Powder Mixers.
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FOR SALE: NORTH-ERIE ¾ Gal. Laboratory Mixer; 25 Gal. Single Blade Tiltable Blender; 5 Gal. Intensive Mixer with 50 H.P. Motor; New or slightly used equipment available from stock. THE H. W. NORTH COMPANY, 1211 Parade St., Erie, Pennsylvania.

FOR SALE: 350 Ton Press—Used 6 months 36" x 25" Platen—High & Low Pressure Modern Pumping System. Write Marco Products Inc., Clifton Heights, Penna.

FOR SALE: 1000 Ton Hobbing Press, Watson Stillman, like new. Can be seen in operation. Available at tremendous saving. The DON MANNING COMPANY, 135 Leighton Avenue, Rochester, N. Y.

FOR SALE: two 24 x 66 used Farrel-Birmingham calender rolls without gears or other accessories, available for immediate delivery. Address Box 1226, Modern Plastics.

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WANTED: Two 8-ounce Reed Prentice, one 12-ounce and one 16-ounce Watson Stillman injection molding machines. Built year 1945 or later. In reply please state price, condition, serial number and year of purchase. Kent Plastics Corporation, Evansville 10, Indiana.

WANTED: One 2½" extruder electrically or oil heated in good condition. Reply Box 1222, Modern Plastics.

WANTED: 24" x 66" or 24" x 68" four roll calender—give complete details—Write Box 1212, Modern Plastics.

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(*Continued on Page 230*)

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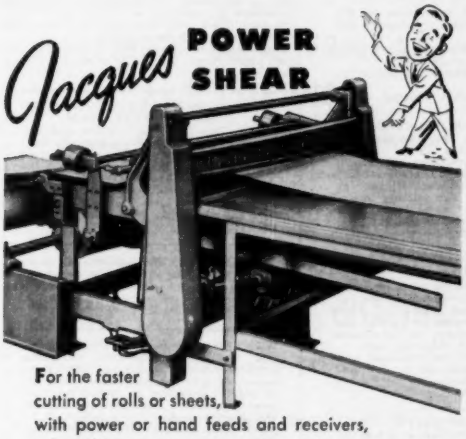

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WESTERN DISTRICT OFFICE: Times Bldg., Long Beach, Calif.

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(*Continued from page 228*)

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WANTED: 4 or 9 oz. Injection Molding Machine. Also 50-150 ton Compression Presses, Preform Press and Electronic Preheaters. State price, condition and year purchased. Reply Box 1200, Modern Plastics.

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FOR SALE: Reground Cellulose Acetate Molding Powder, MS flow: 5000 lbs. Shell, 1500 lbs. White, 3000 lbs. Assorted Pastel Colors. Also 5000 lbs. Ethyl Cellulose, Assorted Pastel Colors. Reasonably priced. Reply Claude P. Bamberger, Inc., 228 Wooster Street, New York 12, N. Y. SPring 7-0933.

FOR SALE: ALL GRADES OF THERMOPLASTIC REGROUND OR VIRGIN. YOUR INQUIRY HANDLED PROMPTLY.
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WANTED: PLASTIC Scrap or Rejects in any form. Acetate Butyrate, Polystyrene, Acrylic, Vinyl Polyethylene, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding, marcetizing and compounding. Reply Box 1185, Modern Plastics.

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CHICAGO 21, ILL.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic and Ethyl Cellulose. Reply Box 1186, Modern Plastics.

WANTED: Plastic scrap, rejects, and surplus molding compounds, such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. Also custom grinding, cleaning, and reprocessing of your own plastic scrap. Reply Claude P. Bamberger, Inc., 228 Wooster St., New York 12, N. Y. Tel: SPring 7-0933.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. Franklin Jeffrey Corporation, 1671 McDonald Avenue, Brooklyn, N. Y. ES 5-7943.

Wanted by large custom molder, large or small quantities of virgin or clean natural reground FM 10001 nylon. Stating quantity, price and condition of material. Reply Box 1195, Modern Plastics.

SURPLUS UREA MOLDING POWDER WANTED. Reply Box 1193, Modern Plastics.

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1 Chemist. Must have extensive experience for manufacture of urea molding compounds.
1 Chemist. With thorough knowledge of manufacturing process of vinyls for molding and coatings.
1 Chemist. With extensive experience in the manufacture of polystyrene principally for molding purposes.
1 Chemist or Engineer. Must be thoroughly familiar with production of fiberglass.
1 Chemist wanted for production of Polyethylene films etc.
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PLASTIC ENGINEER WANTED
Excellent opportunity for experienced man approximately 30 to 40 years old to run Injection Molding plant. Investment possible if desired. Must be able to take full responsibility for production and quality control also be familiar with estimating, die setting, maintainence and supervising. Good equipment. Metropolitan New York Area. Write complete details, include picture. Replies confidential. Box 1207, Modern Plastics.

EXTRUSION DIVISION SUPERINTENDENT
We have a permanent position for a qualified extrusion department superintendent in our expanding plastics corporation. Applicant must be qualified in the management of such a department, including knowledge of extrusion equipment, and designing of extrusion dies.
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Experienced in extrusion of polythylene thin walled tubing and sheeting; capable of setting up complete department. Also require engineer experienced on thermoplastic molding. Chicago firm. Address Box 1206, Modern Plastics.

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(*Continued on Page 232*)

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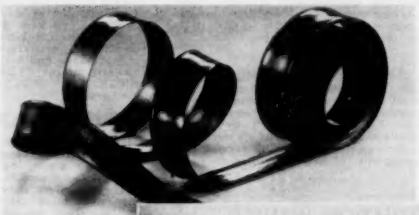

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(*Continued from page 230*)

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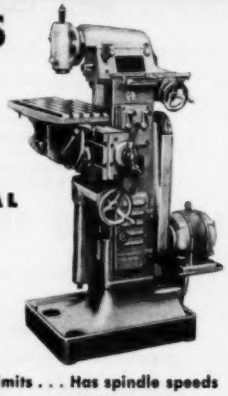

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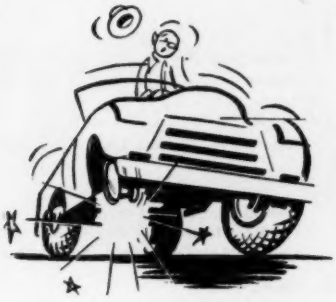

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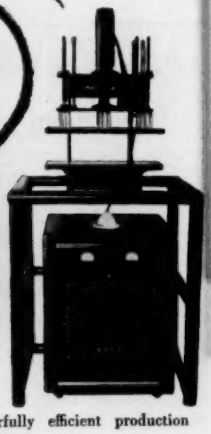

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A Breskin Publication

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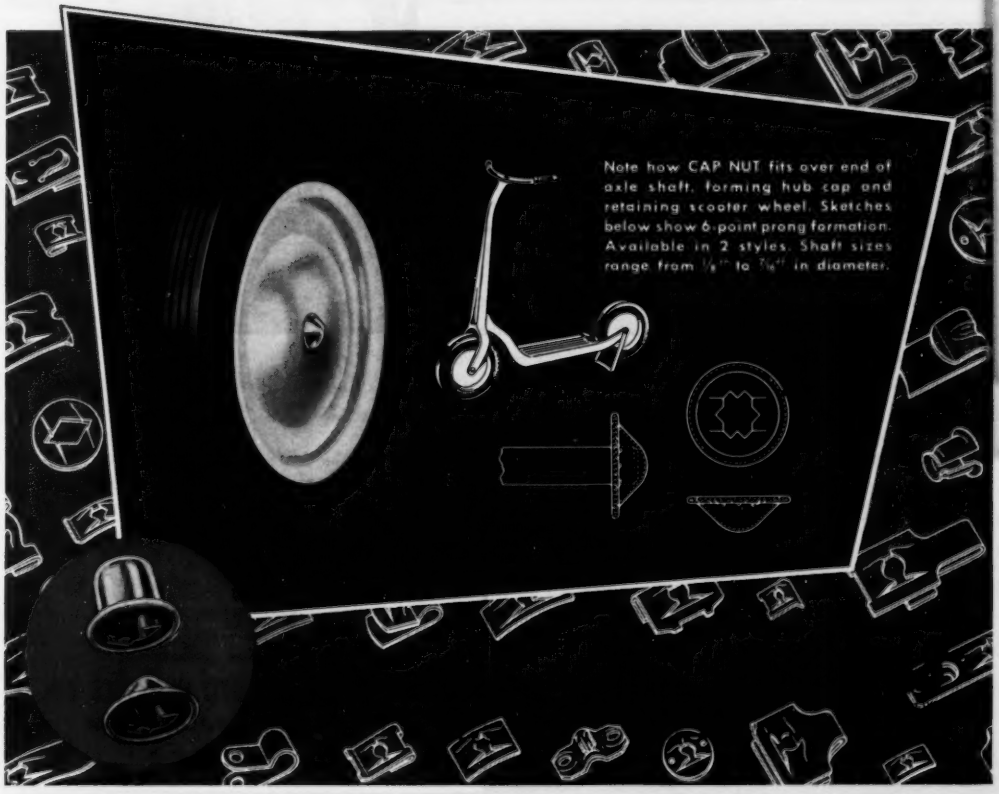
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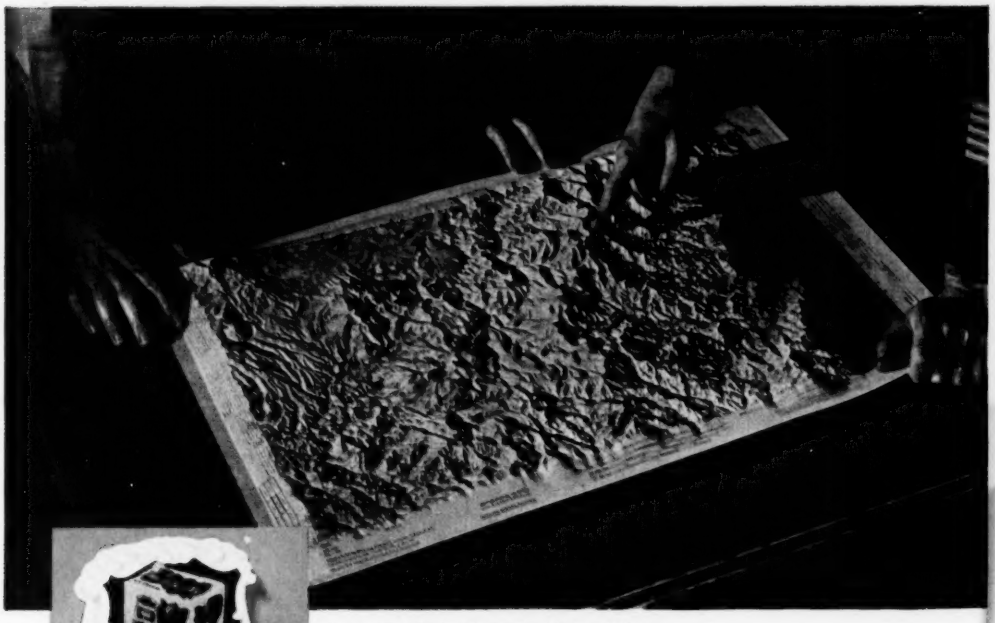

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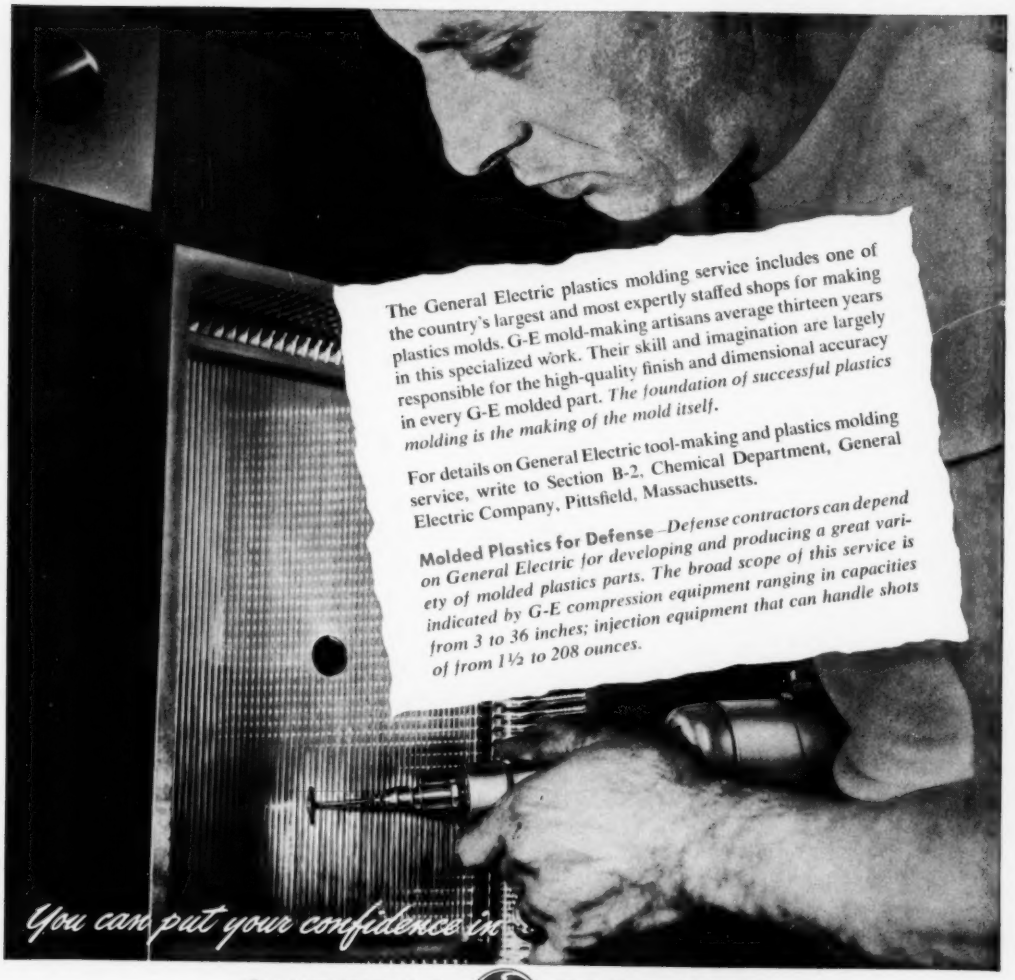

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